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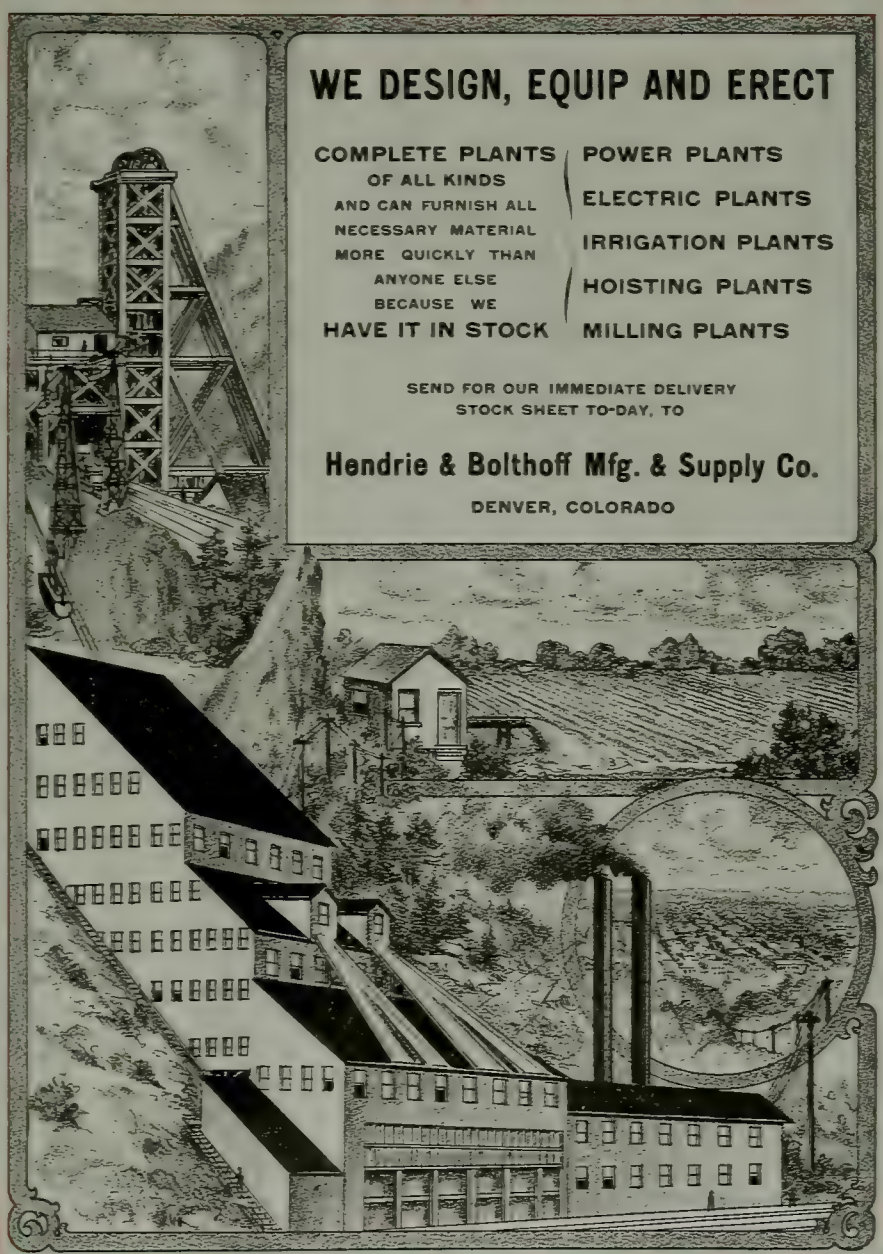
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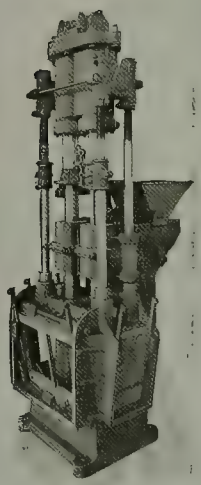
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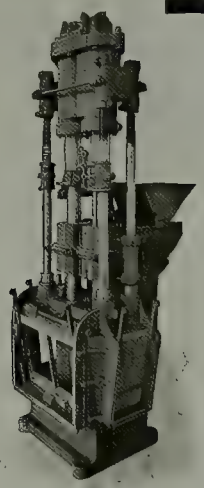


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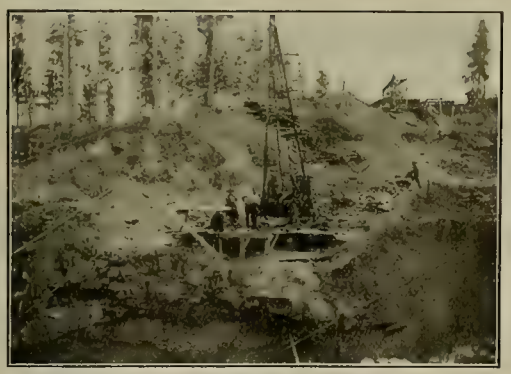


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wide movements of thought receive interpretation varying with latitude, but the meaning is the same. Mankind is striving to make the most of its heritage and to turn each possibility into golden opportunity. The individual desire is the national hope, whether in Venezuela or Germany, in Japan or Great Britain. The units refuse to be ciphers; the evolution of the race demands the adjustment to a new environment created by an extraordinary industrial development. To this dispensation the engineer belongs, in this drama he plays a leading part. It is for him to be an interpreter, not a supernumerary; to be an actor, not merely a scene-shifter; to prove that the recognition of fact does not forbid a noble faith; that he can industrialize his life without commercializing his soul.

T. A. RICKARD.

January 1, 1909.

SAN FRANCISCO, but lately lifting an ashen face from amid the ruins of a great disaster, gives the hand of sympathy to sufferers from the earthquake that has overwhelmed Calabria and Sicily.

REVIVAL of interest in West African gold mining has followed from favorable reports made by Mr. W. Broadbridge and confirmed by Mr. J. H. Curle, who has recently returned from the Gold Coast. In consequence of these reports the Consolidated Gold Fields of South Africa has agreed to provide capital for three of the companies in that region.

FOR THE PUBLICATION of this issue there are needed 110 reams of paper, weighing altogether not less than 5 tons. This consumption of wood pulp and rag is required to make the 11,000 copies that will be promptly distributed to the four quarters of the earth, for we have subscribers on the Arctic tundra and in the tropical jungle, at the University of Tientsin and at Columbia University, in Tierra del Fuego and in London.

THE PRESIDENT used a club to hit a carrion fly when he devoted a message to Congress to the denunciation of *The World* and its slanders. In such matters the impetuosity of Mr. Roosevelt carries him beyond the necessities of the case. But in denouncing the irresponsible periodicals that have made a byword of the American newspapers, he is doing a service. In time the public will recognize the mistake of surrendering their intelligence every morning to the ignorant and vicious scribblers of a debased form of ephemeral literature.

BRITISH mining companies have a plucky way of preferring re-construction to liquidation. When the mine shows signs of exhaustion the management begins scouting for a new mine on which to apply its unexpended capital and its unabated energy. Thus the Oroya Brownhill Company, owning one of the Kalgoorlie bonanzas, has sent engineers all over creation in the search for an attractive mining undertaking and has selected the La Leonesa mine in the highlands of Nicaragua. This gold mine was first examined by Mr. Edmond N. Skinner and has now been recommended after inspection by Mr. C. S. Herzig. The profit assured from ore available is said to exceed the price for which the property is optioned. We are glad to see West Australian companies purchasing mines in the Americas.

REPORTERS, like kings, occasionally bestow the accolade of knighthood with impartiality, if not recklessness. Thus *The Spectator*, of London, recently spoke of Sir Winston Churchill, and even more recently *The Evening Post*, of New York, dubbed Mr. Moreton Frewen with a prefix that does not belong to him, although Sir Moreton seemed not unnatural, seeing that the Western press for years has so, incorrectly, entitled him. Neither Mr. Frewen nor Mr. Churchill is either knight or baronet, although both are clever men, well worthy to adorn the chivalry of the modern world.

COAL, like iron, is so basal an element of industrial development that any facts concerning the distribution of deposits of this mineral fuel are important. On another page Mr. Thomas T. Read, professor of mining in the University of Tientsin, gives the latest information regarding the known coal-bearing areas of China. Should the Celestial Kingdom wake up to modern progress and utilize its industrial possibilities, then these coalfields will become a decisive element of commercial growth and profoundly affect industrial conditions on the western coast of America.

WE CAN IMAGINE how soothing Mr. Carnegie's Scotch stories must have been to the Committee of Ways and Means when examining the spelling reformer on the subject of the price of steel rails. The Chairman might ask him what it cost to make steel and Mr. Carnegie would be reminded of a canny chield whom he met on the golf links at Skibo. The laird of the last mentioned castle would be smiling smugly at his own humor while the committee on the tariff would be yearning to throw a chunk of unprotected iron at the self-satisfied old Scotchman's head. He wrote magazine articles and then declined to testify on the facts.

ANYTHING coming from the pen of Mr. James Douglas is sure to be interesting, and when he tells us of the factors controlling the copper mining industry he will hold the reader's closest attention. Among other important matters he refers to the Producers' Committee, which is to be re-organized and come into active existence late in January or early in February. Incidentally, he explains the kind of combination this is to be—not in restraint of trade, but in establishment of sound business on a basis satisfactory to a maximum number. We are reminded of the Smelter Clearing House established at Denver about 15 years ago. Mr. Franklin Guiterman was the efficient secretary, and though a loose organization it served to distribute various classes of ores where they were needed, to the better attainment of an economical mixture at all the smelters.

The Producers' Committee will do a similar service for the copper mining companies, keeping them informed of the trade conditions and of the varying demand for the metal, so that the marketing of copper may be put on a safe and sane foundation.

LITIGATION over patents is always regrettable because it impedes the development of processes by throwing doubt upon the validity of the license under which a royalty is collected or exclusive privilege claimed. We note with pleasure that Mr. Edward Walker, our London correspondent, announces the conclusion of one stage, at least, in the legal controversy over the patents controlling the use of oil in the concentration of ores. As metallurgists well known to us are interested in both sides to this litigation we can take no pleasure in the victory of either, unless it leads to a compromise or a combination helpful to all concerned.

DURING the year 1908 ample evidence has been given of the gullibility of the greedy. Opera bouffe performances on the Stock Exchange, on the Curb, in the Press, testify to the attractiveness of the old lures and to the effectiveness of the old lies. Lawson, Goodwin, and Hawthorne have been the stars in the financial vaudeville of 1908. One of them was by profession an actor and made the most of the notoriety of the stage to entice play-goers into Nevada schemes for turning water into golden wine; another of these was by way of being a litterateur and lent a facile pen to meritricious descriptions of mines that were to make men rich over night; the third of the trio needs no description, he has been adequately exposed by his own impudent confession. In the advertisement of their schemes these spoofers have been aided by an irresponsible press that preaches morality weakly on one page and offers gold bricks luridly on another page. An old story truly, and the iteration of it is wearisome.

A REVIEW of progress in cyanidation, written by Mr. Alfred James, will be welcomed as the utterance of one who knows the details at first hand throughout the world, who is frankly committed to the introduction of patented devices, but who is broad enough to admit the merits of other systems and to bestow deserved compliments upon competitors. It is a pleasure to accord opportunity of speech through our columns to a man who gives freely from his own store of knowledge for the benefit of others. It is also pleasing to observe the growth of liberalizing tendencies in the metallurgical art. On this side of the Atlantic is Mr. James Douglas strenuously insisting upon the open door and free exchange of data among the smelters; from England comes the plea of Mr. Alfred James for co-operation among cyanide specialists, to the end that waste of effort may be obviated, so that many may not be found groping where the right road has been discovered. On the technical side, the most significant statements made by Mr. James refer to the abandonment of sand-leaching and the tendency to cease amalgamation, relying upon extraction from all-slimed ores. The prediction of 2000-pound stamps reveals the tendency to reduction of costs through attention to mechanical details. This has long been the weaker end of gold-milling. Important also is his concession of the supremacy of the plain table as a concentrator for gold-bearing slime. It seems probable that the perfection of this method may receive increasing attention as a means for improving concentration of slime from all kinds of ore.

FROM NEVADA we have heard that Mr. Charles M. Schwab made some violent remarks concerning mining engineers who advised him to buy mines that failed to prove profitable. That was a year ago. He ought to have known better. "Like master, like man." We read that when examined by the Ways and Means Committee, now investigating the tariff, he was shown a letter written by himself nine years ago in which he advised Mr. H. C. Frick that the Carnegie Steel Company could make steel rails for $12 per ton in defiance of foreign competition. Mr. Schwab, whom the daily press label a magnate, explained that he wrote that letter when youthful and sanguine. He said: "I wrote it at Mr. Frick's request, when he was preparing to sell out, and I wrote it entirely from the point of view of the manufacturing department." There were other items of cost that he had omitted, and these now, with the tariff endangered, he would be glad to add to the $12. And this is the man who fumed and fussed when some of his supposed expert miners, themselves interested in the mining deals, were unfortunate enough to give him reports that proved too rosy in tint for the dry air of the desert.

AMONG the many useful actions of Mr. Charles E. Hughes, the Governor of New York, has been his appointment of committees to investigate alleged abuses in the administration of public organizations, such as banks and tramway companies. Even more timely has been the recent appointment of a committee of experienced men to examine into the methods of the Stock Exchange. Our readers will remember that a few months ago the brokerage firm of A. O. Brown & Co. failed dishonorably, and the members of the firm lost the privileges of the Exchange, because they created fictitious evidence of demoralization by selling blocks of shares having a value far exceeding their financial resources. They were expelled for trading when insolvent, but the authorities of the Exchange failed to make any comment on the case as a flagrant example of practices supposed to be frequent among brokers, namely 'wash' sales: an appearance of abnormal activity on the stock market is created by giving simultaneous orders for the buying and selling of shares of the same description in big amounts but nearly equal, so that on balance no large sum of money is involved. The semblance of excited business inveigles the outside public to come and buy, at rising quotations. By sales between brokers, by 'matched orders,' the transactions of the Stock Exchange are used as a lure to entice those who buy on a "bull movement" and to intimidate those—the same kind of simpletons—who always sell on a "bear raid." During

the Morse trial there was plenty of testimony in regard to such dealings in Ice stock and it was recorded that a syndicate of millionaires was formed in 1901 to create an artificial market for the Steel shares. There is ample ground for suspecting that the Stock Exchange is used by some of its members for chicanery of a base sort and that the National Bourse is sometimes only a casino where crooked games are played. Unfortunately, the Exchange plays a prominent part in the social organism of America and the least that we can ask is that it perform its necessary functions honestly, even honorably.

Price of Silver.

Silver mining has fallen upon evil days; the prophets and reformers find corresponding opportunity for the exercise of their respective talents. Mr. Theodore F. Van Wagenen, in this issue, ventures upon the dangerous function of forecast, promising a comfortable average price for the metal during 1909. No one is better equipped with knowledge on this difficult subject than Mr. Van Wagenen. Therefore it is interesting to observe that he is not befuddled by monetary theories, does not insist upon conspiracy among the Western nations to make the Oriental 'sink of silver' insatiably swallow more, nor does he propose to undo the work that cost Señor José Y. Limantour, the brilliant financial minister of Mexico, so many years of patient labor in his endeavor to give to Mexican currency the stability needful in a modern medium of exchange. He shows where the normal output of silver will be consumed, and on the simple principle of supply and demand, without artificial restrictions or subventions, deduces a price sufficiently high to sustain the existing producers at least. We hear nothing from Mr. Van Wagenen of a proposed change in the monetary standards of the East. China and India have their silver exchanges as we have ours for dealing in cotton and grain, and the flow and ebb of the great tide of brokerage is not unaccompanied by noises that sweep around the world. Just now the 'bears' have it their own way, but to think they wish to wipe out the trade on which they subsist is to misinterpret the Orient. The common people of the East know nothing of all this, and care nothing. They have their immemorial customs, and have not thought to question whether they be good or bad. Moreover, the Chinese tael is not a national coin; the Imperial Government does not monopolize the money-issuing function of sovereignty. Each Province strikes its own coin, so that no uniformity of weight or fineness exists. Each Province distrusts the others; all unite in distrust of the central Government; and the council of foreign powers profoundly distrusts the Chinese political machinery in its entirety. It must be observed that China could not, if she would, undertake a monetary reform without the consent and direction of the Western nations. It is brutal but true—the West holds China in its grip, as a creature to absorb its surplus products.

Constant rumors of declining demand from India are not borne out by the facts. During 1908 the group of Indian principalities embraced under British rule imported a quantity of silver 4.3 per cent in excess of that absorbed in the previous year. The value of these importations, measured by Western standards, shrank 16.7 per cent, but it seems quite certain that the actual consumer was sweetly unconscious of this circumstance when he added the coin to his glittering hoard. The silver miner should bear in mind that he is to a large extent open to raiding by brokers on the exchanges of London and the East, with New York and other centres participating according to their ability. If Mexico also lay open to the spoiler, the fluctuations would be even more extreme and spasmodic. The market would surely rest on shifting sands. More is to be gained from national prosperity in that Republic, from internal improvements, and the growth of industrial stability, than from a temporary elevation of price through the free coinage of silver, which could not long endure. In short, we may persist in exploiting the Orient, but we can not continue exploiting Western nations that have enlisted in the cause of modern progress.

Smelter Competition.

In this issue we publish an article describing the conditions controlling the smelting industry in Utah. The author of the article, Mr. Courtenay De Kalb, was commissioned by us to make a special investigation into the factors that have brought about a crisis in the ore market of the West. For the situation at Salt Lake has more than local bearings; it has brought to a focus the irritation freely expressed for several years against the big smelter consolidation dominated by the Guggenheim family. The failure of the American Smelting & Refining Company to make a satisfactory contract with the Utah Consolidated Copper Company evidently hastened the decision of the Amalgamated people to enter the smelting business on a large scale. It has been announced recently from Boston that Mr. John D. Ryan, president of the Anaconda Copper Company, and Mr. Thomas F. Cole, president of the Greene-Cananea Copper Company, had joined with others in organizing the International Smelting & Refining Company, with a capital of $50,000,000, which was largely oversubscribed. With Messrs. Cole and Ryan are William Rockefeller, of the Standard Oil Company, U. H. Broughton, who is son-in-law of H. H. Rogers, and president of the Utah Consolidated, W. E. Corey, of the United States Steel Corporation, and H. C. Frick, of Pittsburg. Heretofore, the Cole-Ryan coterie has engaged in speculations confined to copper mining enterprises, notably the Amalgamated group at Butte, the Greene-Cananea mines in Sonora, the Calumet & Arizona and other mines at Bisbee, and a number of smaller undertakings. They have avoided trespassing upon the preserves of the American Smelting & Refining Company or the other concerns controlled by the Guggenheims. Now we are told it is to be a fight to a finish; the new company is to build a smelter in Utah at once, and is prepared to erect or buy other plants as its business may require.

Thereupon, Mr. Daniel Guggenheim comes out with an interview stating that the Cole-Ryan people are welcome to any copper smelting that they want, the American Smelting & Refining Company has only one exclusive copper smelter in the United States, and looks upon copper smelting as "an extremely annoying business," preferring copper refining and lead smelting. Mr. Guggenheim adds that 90 per cent of all the lead ores available in the United States and Mexico is covered by ownership or contracts, and, therefore, any new smelting corporation will find it difficult to get this class of ore. Finally, it may be mentioned that the United States Smelting, Refining & Mining Company, controlled by Messrs. R. D. Evans, A. F. Holden, Edward Clark, and other energetic Bostonians, together with financial support from the Consolidated Gold Fields of South Africa, is doing well, having expanded its business both in Mexico and California. This, briefly summarized, is the smelter situation today. It invites further comment.

The Amalgamated company, controlled by the Standard Oil group, has done but little custom smelting in its Washoe plant, at Anaconda, or in its Boston & Montana smelter, at Great Falls. The Cananea smelter and other less important plants owned by this coterie, have been devoted to the treatment of copper ores and such gold and silver ores as made a suitable mixture. No lead smelting has been undertaken; the Guggenheim plants have had almost a monopoly of that field. Modifications and improvements in copper smelting, especially through cheaper roasting and better handling of every kind of furnace material, have lowered costs of copper smelting and increased the use of this kind of fire metallurgy as a basis for treating gold and silver ores that do not carry copper or lead. While lead was the usual collector for the precious metals in ores that were smelted twenty years ago, nowadays the scope of copper smelting in this regard has been enlarged. Moreover, the supply of copper ore has been enormously increased by the discoveries at Ely, Bingham, and Globe, while the source of lead ore has dwindled rapidly at Leadville, the great lead district of the past 25 years, leaving the mines of Missouri and the Coeur d'Alene as the principal producers. These are largely under the thumb of the Guggenheims and assure them a dominant position in lead smelting; in fact, the Guggenheim purchase of the Selby, Everett, and Tacoma smelters in 1905, was largely prompted by the desire to secure the contracts with such important producers of lead ore as the Bunker Hill & Sullivan, the Hercules, and the Federal group of mines, at Wardner, Idaho. To us it has always seemed a tactical blunder however advisable as a method of controlling the ore market, for the Guggenheims to have grasped the smelters on the Pacific Coast. As long as they were independent, the mine owners of the West could feel that they had an alternative market for their ores, and, having this idea, they were not restive under the domination of the Smelter Trust, as the American Smelting & Refining Company, controlled by the Guggenheims, had gradually become labeled. Further, as long as the Smelter Trust was doing a strictly smelting business, there was no marked irritation, but when under the various aliases of the American Smelters Securities Company, the Guggenheim Exploration Company, M. Guggenheim's Sons, and so forth, this powerful group, reinforced by other shrewd financiers, began to purchase mines and to make contracts for the smelting of the ore produced by such mines, using such production as a means for further control of the metal market, then the mine operators, especially of the smaller defenceless type, began to growl in earnest. And who shall blame them? The American believes in freedom of opportunity and the career open to talent, but he is like any other intelligent human being in hating a 'cinch,' in objecting to a tyranny, whether political or commercial. Most of the time he is subject to both, but the subjection is nicely veiled and rendered as pleasant as circumstances require or as the Standard Oil Company, the Southern Pacific, or the Smelter Trust permits. So now the time seems ripe for competition, the conditions are ready for another big smelting company that shall smite the Guggenheims hip and thigh, and deliver the down-trodden, browbeaten mine operator of the Great West! It sounds fine, but it is bitter irony.

Messrs. Rockefeller, Rogers, Broughton, Ryan, Cole, and the other Sunday-school teachers in that group of beneficent and patriotic citizens must smile at the outcry against the Guggenheims, and the use they have made of it for bearing Smelter stock, thereby making enough money to build their own smelter. The mine operator who expects the Standard Oil to do better for him than the Guggenheims is a simpleton. The Guggenheims may have made their yoke heavy, but the little finger of the Standard Oil shall be thicker than the loins of the present Smelter Trust. To paraphrase further from Hebrew history, the Guggenheims chastised the mine operators with contracts, but the Standard Oil will chastise them with rebates. The evidence given in the recent Federal prosecutions of the Standard Oil people has shown them to be the mildest mannered men that ever cut a throat financially or scuttled a ship commercially. No relief lies there. Competition may sober some of the men on the Guggenheims' staff who have been intoxicated by speculation on Wall Street, including several of the seven brothers, and the threat of reprisals from another powerful corporation may abate a little of the arrogance that unconsciously has crept into their late treatment of possible customers, but in the end any such fight as seems in prospect will end either by one predatory group gobbling up the other or a truce highly detrimental to the poor mine operator. Two courses are left to him: One is union for defence, the various individuals and companies that have ore to sell joining in an alliance for their general protection, with the intention of remaining loyal even at some sacrifice; the other is to watch the actions of the smelter corporations, and to invoke both State and Federal interference whenever acts in restraint of legitimate trade are suspected, to the end that they may be prevented and punished.

Go North!

When the world was startled by the output of gold from the North ten years ago, and when that output gave signs of dwindling, the question was asked: What is the outlook for mining in the interior region of the Yukon and Alaska? Mining engineers and geologists knew that the wonderful gold-bearing gravel of the Klondike, of Fairbanks, and of Nome were the result of a process of natural concentration that had been at work for thousands of years. They asked: Are the miners simply skimming the golden cream that can never be re-made, and will the mining operations soon end, leaving nothing but the skimmed milk of low-grade alluvial deposits? The answer is: While the geological dairy operates so slowly that its products cannot be made within the lifetime of the sons of men, it has been at work so magnificently in the past that even though the richest of the cream has been collected, there still remains a vast amount of wholesome milk. The alluvial deposits of the North are not worked out, nor will they be during the life of those now living.

This is an important fact, if true. Discussing the future of Alaska with an official who had good reason to take a friendly interest in the subject, the present writer was informed, last summer, that the placer camps were necessarily ephemeral, and that the future of the country depended upon the development of its copper and coal resources. Our informant had never been 'inside', that is, across the coast range into the spacious region drained by the Yukon, the Tanana, the Innoko, and the Kuskokwim; he was one of those to whom Alaska meant the southeastern province, from Ketchikan to Seward; to him the vague and vast tracts beyond the barrier of glacier and peak were the scene of an excited kind of nugget-hunting such as could not last; it had no industrial future; it was but the arena wherein adventurous spirits risked life and money in a search for rich patches of gold-bearing gravel that were soon garnered and never sown. He was hopelessly wrong.

To the traveler wishing to see a part of the world wholly unlike the beaten tracks, to be with men waging a fierce and cheerful fight with great natural obstacles, to live for a while with human-kind on the farthermost frontier of civilization, where man in the unit dwarfs man in the aggregate, there is no more interesting journey than the tour from San Francisco to Skagway, over the coast range, down the 2000 miles of the Yukon, up to Nome, and thence homeward through the Aleutian archipelago. But it is no journey for a mere tourist; the time and the cost are wasted by anyone not in touch with mining or unable to appreciate the industrial conditions. The tourist wisely sails amid the lovely islands of the inland sea along the coasts of British Columbia and southern Alaska, and then goes by train from Skagway to the summit of the White Pass, getting a glimpse of the 'inside' from the mountain top, and then returns to his proper habitat. To the men of our profession, on the other hand, these northern mining regions must be intensely interesting, both from a scientific and a commercial standpoint. The frozen condition of the ground and the factors modifying the arctic geology present problems new to most of us. The intelligent application of technology in overcoming regional difficulties, the wide distribution of gold in deposits of peculiar character, the labor problems arising in isolated communities, and the bending of every energy to overcome the delays and expense of transport—these are all tasks for the most adaptable of men, the modern engineer. And he can go there knowing that not only will he not risk his health, but he may even upbuild a physical system injured by the miasma of the tropics or the unwholesome life of a crowded city. The climate of the interior of Alaska is superb. Again we find that the average man gets his notions of the country as a whole from seeing a small and easily accessible portion of it. Southeastern Alaska, as typified by Juneau or Sitka, is a wet, misty, and rainy tract along a coast that catches all the humidity of the west wind from over the sea. This excessive moisture brings verdure and a scenic beauty that have particular charm; but it is not bracing to the physical part of man, and it feeds those glaciers with which even the well informed associate the name of Alaska. The southeastern coast is cinctured with rivers of ice; they are splendid spectacles; but once across the range the traveler sees no more glaciers; he is in an arid region, where the air is as it is at Tucson at 4 a. m. in March—that is, it is the air that creation breathed at the dawn of time, as free from microbes as interplanetary space, as stimulating as hope, as invigorating as youth, when "the world was young and life an epic."

Eldorado.

In this issue Mr. F. Lynwood Garrison introduces his discussion of the new mechanical subjection of Eldorado by a retrospect of the old days of adventurous conquest, which cost the lives of men, instead of the mere out-wearing of dumb engines and pumps and chains of buckets. He re-tells the story of the gilded chieftain of the Chibchas, and the golden treasure thrown, as a propitiatory offering to demons, in the lakes upon the plateau of what is now Colombia. That gold was actually cast into the lakes has been demonstrated by the recovery of many ornaments, but whether these were offerings to fancied demons of a supernatural order, or sacrifices made in preference to being looted by invaders from across the sea, is wanting in final confirmation. Some choice examples of aboriginal art in gold, which would have been of enormous value to archeology, were surreptitiously exported from Colombia several years ago and ruthlessly sent by the ignorant discoverers to the melting pot in New York. The legend of another gilded chieftain and ceremonial lake finally blended into that of the fabled Lake Parima and its golden city of Manoa situated on an island in the centre. So persistent was belief in the story that the maps for centuries showed such a body of water in the northern part of South America. Formerly it was

large enough to dwarf Lake Superior, and extended far up into Colombia; as exploration narrowed the limits in which imagination might play, the lake shrank and retreated eastward, resting finally in Brazilian Guiana. There it remained, even upon the school-maps of England and America, until about 1830, when the age of credulity had been so far swept away by devotion to fact that the simple word "unexplored" took the place of the dream-lake and its tempting city. Stories of the lake, of 'white' Indians, and of the gilded man persisted, however, in spite of incredulous geographers. It is interesting to find that usually some basis of fact underlies a persistent legend. This is a case of genuine folk-lore, all the more interesting because of its comparatively recent origin. Jules Creveaux penetrated the district in 1880, and then the truth was given to the world by a reputable and accomplished scientist. The 'lake' is a basin like the Tensas basin, for example, in the Mississippi valley, subject to annual inundation; the 'white' Indians are the Roucouyennes, a pale tribe, remarkable in having children born almost white, similar to the tribe of Ahuarunas in the upper Amazon valley, long known to ethnologists; and the 'gilded man' was found in the person of the chieftain, religiously daubed with clay, and sprinkled with brilliant mica scales obtained from a highly micaceous schist outcropping in the southern foothills of the Tumac-humac mountains. This rite was performed at the time of the approaching flood. Thus resplendent he would take his ceremonial bath. Even the propitiatory element was not lacking. News of these events filtered to the outer world through repetition from tribe to tribe, and kept alive vain hopes long after the real Eldorado had been spoiled of his golden store.

Metal Markets.

During the year 1907 the copper market suffered from violent fluctuations culminating in a low price for the metal early in 1908. Thus, Lake copper sold for 13 cents per pound in February, and for 12½ cents in March. With the exception of small variations, the market evidently was unable to lift itself until August, in which month general conditions became much brighter. Meanwhile, the general business of the country suffered tremendously. The steel industry had to bear the brunt of the depression, and early in the year the larger plants were being operated to hardly 35 per cent of their normal capacity. At this time the railroad traffic also decreased so greatly that 400,000 cars were idle. At every junction these cars stood like ghosts of dead business. The depression affected every trade throughout the country, and so many people in the United States were thrown out of employment that for the first time in its history the steerage accommodations of steamers leaving New York were overcrowded with emigrants returning to Europe. This exodus continued up to the last quarter of the year, when the tide of travel turned. It was only natural that the copper industry should bear its share of the general depression, particularly as the capital needed for larger electric installations was no longer available. Conditions changed as the year advanced, and by October marked improvement was noticeable. This improvement culminated after the Presidential election, and a satisfactory business has ensued since November. Various circumstances, however, interfered with the further progress of this movement, and during the month of December there was a shrinkage, the closing prices of copper being about 14⅛ cents for Lake and 14 cents for electrolytic, with, however, a brighter outlook for healthy development of the market in the coming year.

Production was much curtailed last winter, but from May onward a great many of the mines that had been operated at a reduced rate gradually increased their production. New mines became active, mainly in Utah and Nevada, and at the moment, the production of copper is probably as large as it has ever been. There is every probability of this condition continuing during 1909, for there are no great fears of stocks accumulating. It is true, in Europe, the visible supplies, which about two years ago were below 10,000 tons, are now about 55,000 tons, but that is not at all a menacing quantity when one considers that this is the only reserve in the whole world.

Lead was one of the first metals to advance after the heavy reduction in prices during the panic. The year opened at about 3.50 to 3.60 cents per pound at New York; with an excellent demand, especially for white lead purposes, the market improved by leaps and bounds, until in July, when 4.60 cents was reached. The improvement, which was accelerated by a greatly reduced production, especially in the Western camps, could, however, not be maintained when during the year the mines were again operated in full, and from that time prices gave way from month to month. Since the hearings of the tariff revision have been resumed in Washington, with the probability that the duty on lead and lead ores may be reduced, buyers have become rather scarce, and this helped the declining tendency, the market closing barely steady at 4.10 at New York.

Manufacturers of spelter have had to go through a trying period. During last winter prices fell to about 3⅞ cents per pound at St. Louis and ruled in the first half of the year between 4 and 4¼ cents. Heavy stocks had accumulated, and while they were mainly in good strong hands and not pressed on the market, they exercised a depressing influence. At the same time ores were rather scarce, as it did not pay Western or Mexican producers to sell their product at the ruling prices, and in consequence the smelters had to pay more for the zinc in the ore than they could realize for the finished metal. Matters drifted along until late in the year, when the demand became much more active, and spelter advanced to about 5 cents at St. Louis. The stocks, which were estimated at the beginning of the year to be between 35,000 and 40,000 tons, are now reduced to about 12,000 to 15,000 tons, and as the production is still curtailed it is more than likely that the reserve will disappear entirely within the next few months.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

LIONEL LINDSAY is at Denver.

D. V. BURNETT is in the Transvaal.

J. R. FINLAY has returned to New York.

FRED. J. SIEBERT is at Las Vegas, Nevada.

BEN. S. REVETT spent Christmas at Denver.

R. GILMAN BROWN was in Germany recently.

J. M. CAIRNS has accepted an appointment in Chile.

JOHN A. PORTER is expected at Coronado, California.

T. A. RICKARD went to Pasadena on New Year's day.

THOMAS R. BARBOUR was in San Francisco this week.

D. C. JACKLING has returned to Salt Lake from New York.

HARRY S. PAUL has returned to Alameda from Nevada City.

J. H. CURLE was in Switzerland recently; he goes to Java soon.

J. W. SUTHERLAND, of Kalgoorlie, was in Scotland recently.

P. A. SATON has returned to London from the Malay States.

F. W. NOBS, of Mexico City, spent the holidays in San Francisco.

J. H. BATCHELLER went from Telluride to Boston for Christmas.

FRANK ELMORE was married on December 12 at Kensington, London.

F. C. CROCKER, of Hill City, South Dakota, was recently in Oaxaca, Mexico.

L. N. W. WARD has been appointed manager of the Attasi mines in West Africa.

J. HENRY RICKARD is examining antimony mines at Lake George, New Brunswick.

GEORGE A. GUESS is smelter superintendent for the Tennessee Copper Company.

R. RECKNAGEL is consulting engineer to the Oceana Consolidated Co. in the Transvaal.

PERCY GRAVE is mine superintendent for the Jalisco Mining & Smelting Co., in Mexico.

C. NOBLE CROWE is manager of the Lake George mines of the Canadian Antimony Company.

H. C. BELLINGER has been appointed manager of the Great Cobar smelter in New South Wales.

N. O. S. FORD has opened an office in Oaxaca, Mexico, to engage in mining engineering work.

SPURR & COX are now at 165 Broadway, New York. Branch offices are at Denver and Mexico City.

W. A. CARLYLE has been appointed professor of metallurgy in the Royal School of Mines, London.

J. H. CLEMES has sailed for South America to examine the Choicas mine in Chile on behalf of John Taylor & Sons.

C. W. PURINGTON spent Christmas at Brookline, Massachusetts; he sails for London on January 5.

DAVID GOODALE' and A. F. HUGHES are examining mines near Carrville, in Trinity county, California.

J. V. N. DORR is acting as consulting engineer for the Golden Reward Mining Co. in connection with the remodeling of their slime-plant.

JOHN TAIT MILLIKEN, of Colorado Springs, has been made consulting engineer to the Golden Cycle Company, and A. L. BLOMFIELD has heen appointed superintendent of the Golden Cycle mill.

Latest Market Reports.

LOCAL METAL PRICES—December 30.

Antimony	12@16c	Quicksilver (flask)	$45@46
Casting Copper (scrap)	8½@13½c	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Dec. 24. £. s. d.	Dec. 30. £. s. d.	
Camp Bird	0 16 0	0 16 0	
El Oro	1 7 0	1 6 3	
Esperanza	3 4 0	3 6 0	
Dolores	1 10 0	1 10 0	
Oroville Dredging	0 8 0	0 8 0	
Mexico Mines	5 5 0	4 18 9	ex. div.
Tomboy	1 0 7½	0 18 9	ex. div.

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, December 30.

Atlanta	$ 18	Laguna	$ 1.30
Belmont	78	MacNamara	32
Booth	36	Manhattan Con	5
Columbia Mtn	19	Midway	19
Combination Fraction	1.35	Montana Tonopah	72
Daisy	68	Nevada Hills	1.45
Fairview Eagle	35	Rawhide Queen	33
Florence	4.47	Sandstorm	20
Gold Bar (Bullfrog)	2	Silver Pick	11
Goldfield Con	8.90	St. Ives	19
Gold Kewenas	28	Tonopah Extension	50
Great Bend	26	Tonopah of Nevada	6.50
Jim Butler	18	Tramp Con	10
Jumbo Extension	24	West End	32

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. December 30.		Closing prices. December 30.
Adventure	9⅛	Mohawk	69
Allouez	36½	Nevada Con	19⅛
Amalgamated	83⅛	North Butte	85
Arcadian	3	Old Dominion	57½
Atlantic	16½	Osceola	134
Boston Con	16¼	Parrot	29¼
Butte Coalition	26½	Quincy	95
Calumet & Arizona	118	Rhode Island	5½
Calumet & Hecla	675	Santa Fe	2½
Centennial	33½	Shannon	17¼
Copper Range	81¼	Superior & Pittsburg	17
Cumberland Ely	8	Tamarack	81
Daly-West	10	Trinity	17
Franklin	16½	United Copper Con	14¼
Granby	106½	Utah Copper	46
Greene-Cananea, ctf	12¼	Victoria	3¾
Isle Royale	24½	Winona	6¼
Mass	6¼	Wolverine	150

Comparative Table of Stock Quotations.

NAME OF STOCK.	JANUARY 2, 1908.		FOR THE YEAR. HIGH.		LOW.	
	HIGH.	LOW.				
Amalgamated	48⅛	45⅞	88⅜	Nov. 7	45⅛	Feb. 19
American Smelting	73	69⅜	107	Aug. 7	55½	Feb. 17
Boston Con.	11	10½	18⅛	Nov. 11	10⅜	Apr. 13
Butte Coalition	15⅞	15⅜	29⅞	Aug. 4	15⅜	Jan. 2
Cumberland-Ely	6⅞	6½	10	Aug. 7	6⅛	Feb. 11
Dolores	6¼	6	8¼	May 12	5½	Feb. 26
El Rayo (Jan. 3)	1¾	1¾	4¾	Nov. 11	¾	May 20
Giroux Con.	2¾	2½	7	Dec. 4	2½	Jan. 3
Greene-Cananea	7⅛	6⅞	13	Aug. 3	6⅞	Jan. 2
Indiana Sonora	No sale.		4¾	Feb. 20	4½	Feb. 21
La Rose (June 2)	4⅞	4¾	7⅛	Nov. 9	3⅜	Aug. 31
Miami (Apr. 3)	5¼	5¼	14¾	Nov. 9	4⅝	Apr. 22
Nevada Con.	8⅜	8½	20⅞	Dec. 14	8½	Jan. 2
Newhouse	7¼	7	9⅞	Jan. 20	4⅜	Oct. 22
Nipissing	6¼	6	12	Nov. 4	6	Jan. 2
Ohio Copper (Jan. 17)	3¼	2¾	6	Nov. 30	2⅜	June 15
Tennessee Copper (Jan. 3)	27	26	52¼	Nov 16	25¾	Feb. 17
Utah Copper	21	20	52¾	Nov. 9	20	Jan. 2
Yukon Gold (March 26)	9	8¼	9	Mar. 26	3⅜	July 1

By courtesy of Trippe & Co., 25 Broad St., New York.

The revenues of Mexico for the fiscal year 1907-08 amounted to $111,771,867, and a surplus over expenditures resulted, reaching the sum of $18,594,426. The aggregate surplus over expenditures in the Republic during the 13 yr. from 1895 to 1908 has been $130,000,000. Out of this $50,000,000 has been applied to internal improvements, and the remainder, or $80,000,000, constitutes a reserve in the treasury.

GOLD AND SILVER PRODUCTION.

By courtesy of Mr. Frank A. Leach, Director of the Mint, we are enabled to give estimates of the gold and silver produced in the United States in 1908. Surprise will be occasioned by the fact that the total output of gold is greater than in the year 1907 by $5,878,200. The increase in California is unexpected but cheering; it is to be credited in part to the dozen additional dredges that have been put to work, in part to the cessation of the labor troubles that crippled mining on the Mother Lode in 1907, and finally to the additional gold recovered in the course of the enlarged copper smelting operations in Shasta county. The shrinkage in Nevada is easily accounted for, the rich group of mines controlled by the Goldfield Consolidated company having been in a condition of suspended animation pending the completion of the new mill. Moreover, the panic hit 'wild-catting' severely, and while that is not a profitable form of mining, it does contribute to the sum total of production. Alaska was expected to show a gain, for Fairbanks has redressed the temporary decline at Nome, and outlying new mining districts have yielded contributions which in the aggregate constitute a respectable total. The Treadwell mines produced $500,000 more than in 1907. In South Dakota there is a decided increase, traceable mainly to the Homestake's recovery from the fire underground, and to the improved methods of cyanidation.

In silver, the total decrease is nearly $10,000,000. Nevada shows a notable gain in quantity, although the value is less than in 1907 on account of the smaller price commanded by the metal in 1908. The mines of Tonopah are responsible for the result.

It is probable that the gold production of the world for 1908 was $427,000,000, or about $16,500,000 more than the year previous. This increase is due mainly to South Africa, where the preliminary estimate shows $144,675,000, a gain of $12,000,000. The United States holds the second place. Russia and Mexico both exhibit a slight increase, and the shrinkage in Australasia was only about $2,000,000 in the year just ended.

GOLD AND SILVER PRODUCTION IN THE UNITED STATES.

BY THE DIRECTOR OF THE MINT.

PRELIMINARY ESTIMATE OF THE PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES.

Source.	1908. GOLD.	1908. SILVER, Fine Ounces.	1908. SILVER, Commercial Value.	1907. GOLD.	1907. SILVER, Commercial Value.
Alabama	$ 43,686	1,815	$ 962	$ 27,400	$ 400
Alaska	20,930,784	201,988	107,053	18,489,400	118,300
Arizona	2,345,308	3,046,137	1,614,452	2,664,000	1,916,000
California	19,582,464	1,823,088	966,236	16,853,500	1,049,400
Colorado	22,811,784	10,161,318	5,385,498	20,897,600	7,587,000
Georgia	48,918	186	98	64,800	500
Idaho	1,450,830	6,289,585	3,333,480	1,255,900	5,206,300
Illinois	.....	352	186	.....	1,900
Maine	198	316	167	.....	.....
Michigan	20	232,184	123,057	.....	218,700
Minnesota	1,265	9	5	.....	.....
Missouri	.....	25,000	13,250	.....	16,700
Montana	3,322,551	11,518,913	6,105,024	3,472,600	7,345,500
New Hampshire	2,306	3,482	1,845	.....	.....
New Mexico	240,756	372,950	197,663	330,000	395,700
Nevada	12,089,968	9,322,450	4,930,898	15,411,000	5,465,100
North Carolina	85,314	16,090	8,527	78,700	16,600
Oregon	1,119,528	109,640	58,109	1,222,200	63,400
Philippine Islands	306,708	3,700	1,961	64,700	100
Porto Rico	642	3	1	1,200	.....
South Carolina	58,336	102	54	58,100	100
South Dakota	7,690,294	197,996	104,938	4,138,200	70,400
Tennessee	3,186	59,876	31,734	3,800	38,500
Texas	545	461,715	244,709	1,000	201,500
Utah	3,930,290	7,718,434	4,090,770	5,121,600	7,528,500
Virginia	4,321	8,392	4,448	8,300	100
Washington	222,189	68,175	36,132	262,300	55,400
Wyoming	1,773	634	336	9,400	1,100
Other States	19,936	152,207	80,670	.....	.....
Total	$96,313,900	51,796,737	$27,452,263	$90,435,700	$37,299,700

The commercial value of fine silver in 1907 averaged about 66c. per oz.; in 1908, about 53c. per oz. The production of fine silver in 1907 amounted to 56,514,700 ounces.

THE COPPER SITUATION.

Written for the MINING AND SCIENTIFIC PRESS
By JAMES DOUGLAS.

The copper trade in the beginning of the year just closing had not commenced to recover from the shock it sustained in the previous October when the copper mining interests first became aware of what they should have known months previously—that the bottom had dropped out of the boom. Under the influence of the shock most of the Butte mines, the Cananea mines and, in Canada, the Granby Consolidated, and nearly all the small concerns in the United States and Mexico, suspended operations, producing in the meantime a shrinkage of production that helped to bring about a return to what, let us hope, will be a normal condition. During the winter months Anaconda remained shut down, and Cananea did not resume active operations until September. As a result, the manufacturing trade on both sides of the Atlantic was enabled to absorb practically the whole of the somewhat restricted output, and by the time these large concerns re-entered the market as producers, the gradual restoration of confidence, and corresponding healthy demand for copper, permitted these additions to the metal market being absorbed without disastrous effects upon the price. As the year closes, therefore, all the old large producers are again almost in full blast, and some new producers have entered the lists. The deficit from the suspension of some older mines has probably been fully met by contributions from Utah and Nevada.

The year's statistics will probably show a production not widely different from that of 1907. The production of the large mines in southern Arizona has been maintained quite up to the normal. The only producer in that region, including northern Sonora, which has enlarged its capacity, and correspondingly increased its output, is the Moctezuma Copper Co. The concentrate made in the new mill, where the capacity is from 1500 to 2000 tons of ore per day, more than double the capacity of the old concentrating mill that is now out of commission, is shipped for metallurgical treatment to Douglas, Arizona. The Pilares mine of the Moctezuma company may be expected to continue turning out about 2,000,000 lb. of copper per month. The smaller mines in the Moctezuma district have not yet recovered from the shock of the crisis, and have produced nothing during the past year, and continue in a state of suspended animation. The Greene-Cananea Co., however, has resumed work under such improved conditions as to convert the old suspicion of failure into a practical certainty of economic success. The long period of suspension was the reverse of being a period of idleness. When work was resumed in September, not only was the old smelting plant rebuilt, upon the original site, but the general design of the furnaces and the methods of furnace-treatment were so improved that on starting, two-thirds of the old production was made with less than one-half the old plant in operation. A more important improvement than the reform of the blast-furnace and converting departments has been the success attending the reverberatory practice as applied to the smelting of flue-dust and concentrate. Using oil as fuel, half the heat is recovered in the generation of steam, and, by ingeniously feeding highly silicious ore in a steady stream through the roof in contact with the side-walls, it is fettled economically, reducing notably the wear and tear while smelting a highly refractory ore. The bedding system, also designed under the management of Arthur S. Dwight, has been worked out to a practical success. Thus L. D. Ricketts, with the co-operation of Charles F. Shelby, is rescuing a great property from a dangerous position. In Arizona no metallurgical novelties or experiments, not previously under way, have to be recorded.

Steps have recently been taken to revive the Copper Producers Committee, which for some years, under the secretaryship of the late John Stanton, served so useful a purpose. Gradually the old-fashioned principle of secrecy is being weakened, and public companies are being brought to recognize that, if the public endows them with certain corporate rights, they owe to the public certain corporate duties, and, among others, information as to the speed with which they are using up the national resources. To what extent they should divulge their financial as well as their technical operations is a matter upon which opinions necessarily differ; but nearly all have come to admit that their interests are best subserved by taking the public to some extent into their confidence. Prices, for instance, would be more justly regulated by the common sense of the mercantile world than by any combination of manufacturing interests, if the actual facts of production and consumption were known and believed. As it is, the stock of copper, so far as brokers can trace it, is published; but no one supposes that the published figures are absolutely correct, because copper stored by speculators, and the stock of crude material in the hands of the mills, is always a matter of uncertainty.

During the summer before last, had the producers been aware that the demand for copper really fell off in the spring, with the suspicion of a short harvest, they would not have gone on turning it out at maximum speed for some three months longer, during which period the mills were working off the stocks they had undertaken to buy at an exorbitant price. To escape such contingencies a system of contracting ahead would have to be modified, and more perfect harmony of information established between miners, smelters, manufacturers, and the public. This could not be done without the creation of something that would bear a close resemblance to a 'trust' of the most extreme description, and yet, if such a system could be honestly and thoroughly carried out, in all the great branches of trade, it would eliminate those sudden and woefully disastrous shocks which every now and then tend to shatter with earthquake violence the whole industrial system of modern society. If the committee, to which reference has been made, can be re-organized and the result of the accurate information communicated to their statistician be made public, one step at any rate will be

taken toward the consummation of an ideal bureau, which would act as a medium of perfectly reliable information between those producing crude and highly finished articles of commerce and the public that consumes them. If the coming year, therefore, should prove that the motives, whatever they may be, that caused the suspension of the old committee, no longer possess men's minds, and a new committee should be organized, to communicate not only to the trade but likewise to the public the movement of so important an article as copper, and if this be done without any approach to a combination for governing the price, it will mark a distinct impulse in the public mind toward general confidence. It is to be hoped that the large producers on both sides of the Atlantic will co-operate. If 1909 sees a resumption of mutual trust among the producers, may not 1910 see an extension of the same feeling between the producers, manufacturers, and consumers? The tendency of co-operation as at present practised is inevitably leading to state socialism. State socialism means the obliteration of individualism, and all the stimulating influences, good and bad, that are involved in competition. The only brake that can be put upon this undesirable consummation, at least according to the judgment of many men, is by the banishment of secrecy, and therefore of suspicion, between the great corporations and the public.

LONDON MINING MARKET DURING 1908.

By Our London Correspondent.

The year 1908 has been a discouraging one altogether, whether you look at it from the point of view of the mining engineer, shareholder, or promoter. During the last eighteen months, the general industrial depression has caused a slackening in the demand for metals and the consequent fall in price has adversely affected the profits of existing companies and prevented the formation of new ones. The first half of the year was much worse than the second, for during the last few months it has occasionally been possible to place new schemes before the public. For the purposes of this article I have looked up my file of prospectuses of new companies issued during the year; it is a very small file, the smallest that I have collected during the 15 years that I have been keeping records of new companies.

The two most interesting flotations have been the Russian mining enterprises, one the Lena Goldfields and the other the Kyshtim Corporation. The former had been on the stocks for a long time awaiting a suitable time for flotation. It was organized by the Venture Corporation in conjunction with the Consolidated Gold Fields of South Africa, and the Consolidated Mines Selection. This is one of the frozen gravel properties of northeastern Siberia and undoubtedly will prove profitable, but the public subscribed for only a small portion of the issue and the promoters had no easy work to bring the flotation to a success. The other company, the Kyshtim, is a copper company in Perm that promises to do well. Siberia has also won prominence during the year by the re-organization of the Siberian Proprietary with its subsidiaries, the Orsk and Troitzk. These originally commenced operations under conditions reminiscent of wild-catting, but during the past year the responsibilty has been put in the hands of a reliable firm of mining engineers. The operations at the Spassky mine in Akmolinsk have not progressed rapidly of late, owing chiefly to retarding local conditions. The controllers of the company have introduced to the London public recently another copper property not far away, the Atbasar, which I described only a few weeks ago.

There is an inclination among promoters to turn their attention to South America, and if times were only of a more booming kind, no doubt we should hear a good deal about Chile, Peru, and Bolivia. The only companies publicly floated for handling South American enterprises have been the Poderosa, a copper mine in Chile, and the Queen Gold Dredging Co. in Tierra del Fuego. As regards Cornwall, the only two advertised prospectuses were the Boscaswell and the Wheal Fortune, the first of which was a bad failure, and the second only a moderate success. In other ways a good deal of money has been put into Cornwall during the year, notably at Clitters and South Crofty, where additional capital has been subscribed.

North America has been represented by two prospectuses, the Van Roi and the Canada Iron Corporation. The Van Roi was floated by Le Roi No. 2, to acquire the Vancouver silver-lead properties, and the Canada Iron Corporation was formed to consolidate the Canadian Iron & Foundry Co., the Canadian Iron Furnace Co., John McDougall & Co., the Annapolis Iron Co., and the controlling interest of the Londonderry Iron & Mining Company.

During the year, the public has been invited to invest in two companies of technological interest. The Tungsten Metals was formed to treat wolfram ores from Cornwall, and Steelite Explosives was organized to manufacture a new mining explosive. During the last few weeks people interested in oil and bitumen properties on the east coast of Africa have been active and the prospectuses of the Gold Coast Oil & Bitumen Co. and of the British Colonial Petroleum Corporation have been circulated. There is a generally accepted opinion that these oilfields will become of importance before long.

As I have already said, the efforts of the directors to raise additional capital for previously established companies have necessarily been strenuous during the past year. In more palmy days, the new shares of a company that had proved its property could be issued at considerable premiums. In many cases during the year money could only be obtained by issuing convertible debentures of preference shares that carried a right to nearly all the future profits. Notable examples of this were the Zinc Corporation and Stratton's Independence. Another difficulty in conection with the raising of new capital has been the decision in the courts defining the rights of minority shareholders not agreeing to re-construction and assessment. All sorts of devices have had to be invented for circumventing this difficulty.

NEVADA IN 1908.

Written for the MINING AND SCIENTIFIC PRESS
By J. H. G. WOLF.

The past year's mining in Nevada presents a subject of many-sided interest. What is considered Nevada 'mining' by the general public is merely a contracted view of a broader subject. Nevada 'stocks' have depreciated in value within the period in every camp, and save in the cases of a very few companies the depreciation has been from 50 to 500, and even 1000%, while numerous mines have been proved, and are on the road to an early production. This is gratifying to the discriminating investor; it is also a condition fraught with gloom for the mere stock-seller, and the irresponsible promoter.

The chief instrument in producing the change has been the money stringency following the panic of 1907, thus shutting off the supply of funds that sustained ventures of no merit; another factor was the construction of mills in most of the camps, providing means for testing ground that was assumed to be valuable—but was not. Incidentally, in this testing process a few reputations were blasted, and some spectacular figures in Nevada mining were withdrawn. Chas. M. Schwab found that gold and steel would neither amalgamate nor alloy. Mr. Schwab found gold in steel originally, but learned that winning it from mere earth and rock was a more elusive matter. He was unfortunate in interpreting the recommendations of his advisory engineers. Mr. George J. Oliver, also famous in the steel industry, has been more successful, as may be assumed from the results at the Pittsburgh-Silver Peak mine.

Through the agency of mills constructed during the past year the foundations were laid for an assured and continued production of increasing proportions. The cost of mill construction, of complete plants doing fine-grinding and slime-filtering, has remained about $7000 per stamp. The bulk of the production of the precious metals came from the new camps in the southern part of the State. These will continue to attract money for exploration. In the vast expanse of the southern desert it is hardly reasonable to suppose that all the Tonopahs and Goldfields have been discovered. Development in the new camps has revived activity in the old camps. The improvement in modern methods has resulted in success where nothing could be done before, as at Pioche.

On the economic side, the development of the mining industry made a gratifying advance. Tonopah and Goldfield were given a new outlet to the southwest in the completion of the Tonopah & Tidewater railroad. The Western Pacific railroad construction in Nevada advanced materially, and the eastern part of the State, through White Pine county to Ely, is in railroad communication with Salt Lake, thus giving a shipping outlet for ores from that district. The railroad has also made possible the development of the great copper deposits at Ely, which are among the greatest in the West. In a new schedule just published by the railroads in southern Nevada, the freight rates on all classes of ores are reduced 50% to meet the competition engendered by augmented milling facilities. The Nevada-California Power Co. has completed its three-step development of Bishop creek, on the eastern slope of the Sierras, and is now prepared to furnish all the power southern Nevada can use for some years to come. The Company has built a duplicate transmission line to Millers, near Tonopah, to ensure uninterrupted service. It has begun an extension of its lines from Millers up Smoky valley to Manhattan and Round Mountain, unaided by guarantees from the mining interests. The length of the transmission line to Round Mountain from Bishop creek will be 142 miles. The labor conditions of the camps have been bettered by the organization of a State police force to maintain order and to prevent rioting in time of labor disputes.

Goldfield is unquestionably the leading district, in population, in production, and in breadth of mining activity. The year has seen no widening of the productive area; the development has, on the contrary, limited it more closely to the zone heretofore proved. This does not augur well for 'outside' properties, but it does not necessarily condemn them; their shares have steadily declined as geological conditions have been deciphered. The shares of the two large companies, the Consolidated and the Florence, are now fairly firm at $9 and $4.50, respectively, representing valuations on their outstanding stock of $32,500,000 and $5,500,000, respectively. It seems questionable whether they will be able to pay the anticipated 20% dividends on such capitalizations. The mills of these two companies have just begun to drop stamps. The Consolidated mill was designed under the supervision of J. H. Mackenzie, the general manager, by the following staff: J. B. Fleming and G. B. Shipley, mechanical engineers, and F. L. Bosqui, metallurgical engineer. The successive steps of treatment in the new mill are (1) stamping, (2) plate amalgamation, (3) tube-milling, (4) secondary amalgamation, (5) concentrating on Deister slime-tables, (6) agitation in Pachuca tanks, (7) vacuum-filtration, (8) precipitation with zinc dust. Under the direction of the general manager a sub-plant has been installed to treat the concentrate on the ground, using the sulphuric acid process, first neutralizing the base metal content, followed by cyanidation. The various mines of the Consolidated are connected by a standard gauge electric railroad with a mill on Columbia Mtn. On December 26 the new 100-stamp mill, with cyanide annex, was started. The capacity of the plant is estimated at 600 tons per day, and the cost of the plant is estimated at $760,000. With the railroad, concentrate plant, and water system, the total expenditure will be $900,000. The mill feed is expected to average $35 to $40 per ton, of which 94 to 95% is to be extracted. The total costs of mining, development, and transport are expected to aggregate $3.25 per ton, while the cost of milling is put at $2.75, so that the total operating cost is estimated to be $6 as soon as the mill is in full operation. During 1908 the mining operations on the Consolidated properties have been mainly of an exploratory character, shipments of ore being curtailed. The total profits for the eleven months ending September 30 have amounted to $552,329.

The Florence mill consists of 20 stamps, with provision for 20 more, and follows in a general way the methods of other successful plants. The mill is not of a unified design, and has been under construction for a year and a half. With the phenomenally rich orebodies opened within the year by the numerous lessees on the company's ground, added to the ore opened in the earlier operations, the Florence should be able to establish a record within a few years. Summing up the Goldfield situation, if the reports in circulation as to the ore reserves be accepted, the highly productive era of the camp should be only dawning, but the future will in all likelihood repeat the history of so many districts, where the rich ore near the surface has been quickly extracted, followed by periods of depression and slow search for additional ore at greater depth and under harder conditions. A mark of the progress of the times was shown in the settlement by arbitration of the dispute between the Jumbo Extension Co. and the Consolidated, and between the Combination Fraction and the Consolidated. This sensible method was also used at Tonopah to settle the contentions of the West End and the MacNamara companies, which had been in the courts for some time. The basis underlying the compromise was the limiting of bounds to vertical planes.

At Tonopah, conditions have been seriously affected by the continued depression of silver. Tonopah is the oldest of the new camps, and is the greatest producer of the white metal in the State. Silver recently dropped to 48 cents, at which price it requires rich ore to make mining profitable. The shares of the Tonopah companies have dropped to depressing figures, despite the better facilities that now exist for milling the ore. The limits of the producing area have been known for some years, and the leading mines have but lately resumed exploratory work for additional ore below the dacite intrusion. The Tonopah Mining Co.'s 100-stamp mill at Millers, 13 miles below the town, has been reducing 13,000 tons of ore monthly, having a reported average assay-value of $21 per ton. The 60-stamp mill of the Belmont, also at Millers, has extended its sphere of operation to custom work for other Tonopah mines. The Montana mine has built a 40-stamp mill in the camp; it is doing excellent work on a complex silver-sulphide ore, using the following treatment process: (1) stamping in solution, (2) primary concentration upon Wilfley tables, (3) tube-milling, (4) secondary concentration upon Frue vanners, (5) agitation in Hendryx agitators, (6) vacuum-filtration, (7) precipitation on zinc dust. An extraction of 90% is reported. The monthly ore output of the Tonopah mines has averaged about 24,500 tons.

The Bullfrog district is the railroad centre of southern Nevada. Cheapened transportation, with electric power, has hastened mill construction; half a dozen plants have been erected. The ores are proving lower in grade than was expected, compelling some of the mills to shut down. Gold is the predominant metal in the ores. The Montgomery-Shoshone, the largest mine in the district, is opened to 600 ft., and is producing $40,000 to $50,000 monthly.

Manhattan has made progress toward bettering its condition during the year. Four mills have been erected, and do custom work; one is equipped for fine grinding and slime-filtration. The mills await the advent of electric power to cheapen working costs. The mines generally are without capital to do deeper work, hence the leasing system prevails. Litigation over title has tied up much property that is believed to be valuable, especially at the east end of the district; consolidation of holdings would materially improve the situation and attract capital to make the better prospects into mines. Manhattan stocks have suffered much in the general depression. Favorable placer possibilities now appear in the main gulch below the camp.

Round Mountain, yielding gold ore that is exceedingly easy to treat, has made a record in production from its four or five small mills, greatly enhancing the output of Nye county. The camp has held its own through panics and through stress of adverse conditions, such as the lack of cheap power and transportation. Meanwhile the principal mine has been proved to a depth of 700 ft. The hydraulicking operations, following the good results obtained by dry-washing the year before, were hampered by lack of water. The small seams of gold, so abundant in the rhyolite country along the mineral zone, have created excellent possibilities for placers.

The Blair mine, of early days at Silver Peak, situated 30 miles west of Tonopah, was taken over by a Pittsburg syndicate, which has developed it into a mine of importance. For the quick and economical development of the property, a standard gauge railroad, 18 miles long, was first built to connect the mine with the Tonopah & Goldfield railroad. A mill of 100 stamps was erected and put in operation in April; the reported production has been $750,000 to date. The treatment used is stamping, amalgamation, followed by cyanidation, leaching the sand, and treating the slime in the Merrill filter, of the type used at the Homestake mill in South Dakota. The mine, embracing 8000 ft. of lode which outcrops along the Silver Peak range near its crest, is at an elevation of about 2000 ft. above the town and the mill, with which it is connected by an aerial tramway 2½ miles long.

Fairview and Wonder have been quiet during the past year. The Nevada Hills, the producing mine of the former district, has confined its operations principally to development work, though some ore has been shipped. Lack of transportation and cheap power are obstacles here as well as at Wonder. These camps yield chiefly silver, and the price of that metal has been a deterrent upon operations. The Nevada Wonder has been developed to 500 ft., and the ores are being tested on a large scale to determine the best methods of treatment. A mill will probably be built during the ensuing year.

Rawhide is the newest of the Nevada camps to bid for favor and support. It is situated about 100 miles southeast of Reno. A mineral showing of promise is found in eruptive rhyolite and andesite, outcropping on the low summit of the range dividing Gabbs valley from Walker lake. In April, at the height of the boom, 7500 people found shelter there;

the fire in September swept away the business centre and caused an exodus. The camp has been opened by the leasing system, to the exclusion of company operations, and the work done to date gives promise of proving the worth of a number of mines. The shipment of ore has helped materially to pay for further exploration. The ores contain both gold and silver, the former in the rhyolite on McLeod hill, while gold and silver are found together in the silicified breccias forming ore-zones in the later rocks. No reduction works of importance have been erected; a railroad is projected, and the grading partly done, to connect Rawhide with the Southern Pacific tracks at Walker lake, where the conditions are favorable for cheap milling. Barring the trials that beset all new camps from the evil effects of misrepresentation in the effort to sell stocks, Rawhide has a favorable chance of winning an assured position.

The copper district of Yerington, in Lyon county, has been the scene of energetic development, in the course of which shipping ore has been steadily marketed. The projected smelter has not been built.

The promise of Ely, the camp in the eastern part of the State which was explored in the early days for gold, has been realized in the great work carried to completion by the Guggenheims. Twenty million tons of copper ore available, assaying about 2%, have been proved, and a reduction plant of large capacity is now in operation in the Steptoe valley, 22 miles distant. The first mill-unit of 1500 tons was started in July. With practically unlimited capital and the best engineering and metallurgical talent in the country at the command of the enterprise, it stands today as Nevada's greatest mining enterprise.

The review of mining in Nevada for the year is not complete without referring to the Comstock and Virginia City. The present yield from that famous locality may not be important, but it is significant of energies not wholly decadent, and also of what may yet come from the famous Lode if success follows the efforts of those seeking to rehabilitate these famous mines. The record of the Comstock's production of the precious metals in the past is enormous—greater than the present annual output of all the mining districts of the Western States. The production for the year will be roughly $750,000, taken principally from the Ophir, and the Chollar, and the Yellow Jacket croppings, which, while small compared with past yields of $2,000,000 per month when the mines were in bonanza, is still important. It does not, however, present a favorable appearance, in view of the $800,000 collected annually in assessments. The outcry against the Comstocks is not because of the mere fact of levying and collecting assessments, but is against the want of faith in the disposition of the money, and the small amount of mining actually performed on many of the properties. With but five shafts remaining open (that are not caved) along 2½ miles of the Lode, down to the deeper workings below the Sutro Tunnel, there is little hope of an early general resumption of mining on the deep levels, where commercial ore is most likely to be found. One of the above shafts is filled with water to the Sutro Tunnel level, and in a second shaft the water is about 300 ft. below that level. The sum of all the assessments collected in a year will not suffice to reclaim a single lost shaft, nor restore to good condition the Sutro Tunnel with its branches, upon the maintenance of which the possibility of deep mining depends. A favorable element in the work of rehabilitation is the broad treatment given the difficult problems by the engineers in charge. The Lode with its 200 miles of mine workings, much of which, however, has collapsed, must be treated as a whole to accomplish anything effective. The works planned with the machinery already installed are of such character and capacity as will suffice for almost any situation that may arise on the resumption of deep mining. The Reidler pumps, at the C. & C. shaft, having a capacity of 4500 gal. per min., and the Deane pumps of 3300 gal. per min., at the Ward shaft, working against a 1500-ft. head, represent the latest and best installations of their kind. Both are electrically driven. One of the Deane pumps is now set temporarily on the 2475-ft. level, but both are intended to be placed permanently on the 3100-ft. level. Sinking from the 2550-ft. level is ready to be resumed at this shaft, but with a pressure of 400 lb. per square inch against the restraining works holding back the waters on the Gold Hill side. The status on the Comstock might be disturbed beyond the mere drowning of the pumps if the Gold Hill flood were let down upon them. The present dependence for ore is upon the north end. The Con. Virginia opened during the summer a lens of ore on the 2150-ft. level, but it has not afforded a large tonnage. The Ophir stopes from the 2000 to the 2200-ft. levels continue to yield good ore at the rate of $10,000 to $12,000 per week. The character of the ore, and the ratio of 45 to 55 between the gold and the silver continues as in the upper levels. Ore of comercial grade has not yet been found on the 2300-ft. level. In the Mexican, ore has been found in driving northeast from the north line of the Ophir on the 2200-ft. level. With the changing character of the weekly assay-report it may be assumed that the drift is being run on the apex of a lens. From the position of the ore in neighboring ground, there is warrant for the belief that an important orebody will be found in the vicinity. This is the one mine on the north end that has not yet produced ore. Reform the Comstock? It is an idle and an unnecessary suggestion. It is for the stockholders—the mine owners—to combine their properties for economical working, to support the measures laid out for rehabilitation, wherein lies the possibility for an early resumption of mining on a scale at all comparable with the expectations which its past history has fostered.

The immediate hope of Nevada lies in several small gold camps, any one of which may develop to greatness. At Seven Troughs, two or three mills have started; Chafey looks cheerful, although the ore is low-grade. Old camps like Pioche, Searchlight, and Silver City are being resuscitated. Aside from these is the outlook for a great revival of lead mining in the vicinity of Las Vegas, and the development of new impregnated copper deposits like that at Ely is predicted.

ALASKA AND THE YUKON.

Written for the Mining and Scientific Press
By T. A. Rickard.

The history of gold mining in the extreme northwestern corner of the American continent divides into two periods: one characterized by the discoveries near Juneau, with the development of the Treadwell lode, and the other by the uncovering of rich placers at Dawson, Nome, and Fairbanks. The first period started with the finds made by Juneau and Harris on Gold creek, in 1880; the second and more important series of events began with George Carmack's discovery on Bonanza creek in 1897. Between these two dates some desultory prospecting was done along the coast, and a little placer mining at Forty-Mile, Circle, and elsewhere in the watershed of the Yukon. During this interval the Alaska-Treadwell gave fame to the region, encouraging the hope that other large ore deposits might be discovered. Indeed, some rich mines were found on Berners Bay and elsewhere in the Juneau district, but the vast interior of the country, now the scene of such productive activity, remained unknown and disregarded.

Since 1897 the alluvial deposits of the Yukon and Alaska have yielded fully $200,000,000. This has been extracted at a profit unusual in mining, as it was derived from superficial concentrations of gold-bearing gravel, comparable in their richness to the deposits that excited the world in the early days of California and Victoria. The feverish production of gold from the Klondike and Tanana valleys, and from the beaches of the Seward Peninsula, lasted for two or three years. Since then there has been a decline in the yield. The decrease has led to the query whether, after all, this phase of mining must not necessarily be short-lived, being dependent upon small and shallow deposits of extraordinary richness, rather than immense accumulations of gold-bearing material such as have afforded the basis for long-continued operations in older mining districts. I confess that when I started last June to make a journey of observation through the North, it was with the expectation of finding evidence of an ephemeral industry. Men who ought to have been fairly well informed had told me that the placers were showing signs of exhaustion and that for an assured future Alaska must look to her copper and coal resources. That view, moreover, accorded with experience elsewhere. But it was wrong.

Leaving San Francisco, the traveler goes by sea for 1700 miles before he reaches Skagway; there the railroad of the White Pass & Yukon Route takes him over the coast range to White Horse, a distance of 112 miles; then he descends on the upper waters of the Yukon river to Dawson, another 450 miles. From Dawson the journey down the Yukon, now a lordly river, is 1600 miles to Bering Sea, with 110 miles more to Nome. From Nome to San Francisco direct the voyage is 2730 miles. Thus, after crossing the coast range by the White Pass, at an altitude of 2880 ft. above tide-water, and only 20 miles distant from the wharf, the traveler descends the Yukon for 2144 miles before he reaches the sea again. These figures are cited for the purpose of emphasizing the extent of the region. The District of Alaska covers 580,000 square miles, and the Yukon Territory, 200,000. Until some notion of the immensity of the area is obtained, it is impossible to realize the difficulties of transport, the relative insignificance of the population, and the limitless possibilities for further discovery.

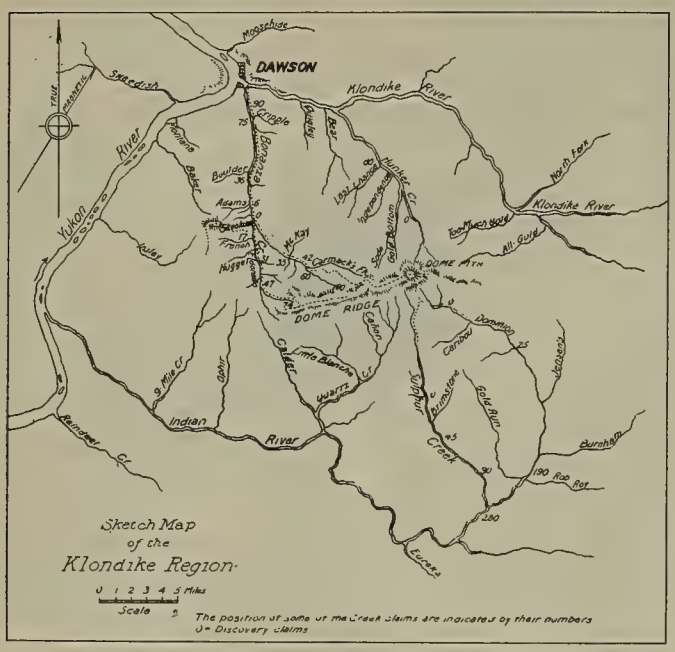
Dawson and the Klondike.

Dawson is the first important mining centre reached by the traveler. It is true that there are some promising copper mines at White Horse, and on the Stewart, White, and other tributaries of the Yukon work is in progress, but as I purpose making a broad review of the country and of its future prospects, we shall land mentally at the mouth of the Klondike, where Dawson spreads itself along the river front. It is not necessary to recite the tale of first discovery, the stampede that amazed the world, nor the evolution of mining methods, each of which would form matter for an interesting story. Let us see Dawson as it is today. Until three years ago the mining operations of individuals, syndicates, and small companies sufficed to exploit the rich claims that had been located on the various creeks flowing into the Indian river and the Klondike, both of which are tributaries of the Yukon. The creeks are thus divisible into two principal groups: (1) those draining northward into the Klondike river, including Bonanza, Hunker, and Eldorado, and (2) those, on the south side of the Dome ridge, flowing into the Indian river, such as Dominion, Sulphur, and Quartz. While the second group has yielded a good deal of



Map Showing Relative Size of Alaska.
After U. S. Geological Survey.

gold (about $25,000,000), the bulk of the output (or $100,000,000) has been derived from the first group. At the present time mining is proceeding in a desultory manner on the south side of the Dome, but an enlargement of the scale of operations is likely next season. The main centre of activity is on Bonanza and Hunker creeks, where a large consolidation of property has been effected. After individual mining in a sporadic manner had proved the richness of the creek deposits and had led to the discovery of important bench gravels, an English promoter named A. N. C. Treadgold succeeded, by persistence and obstinate good sense, in obtaining options on enough claims to form the nucleus for a big mining enterprise on the Klondike watershed. He succeeded in enlisting the financial participation of the Guggenheims and the technical assistance of the engineers employed by that enterprising family. Thus the Yukon Gold Co. was created.



In the creek-beds of the narrow valleys are fluviatile deposits of extraordinary richness. Most of the claims have been worked already, and the tailing from the first operations is rich enough to be reworked. But some of the ground is virgin, and will yield as much as $2 per cubic yard through a depth of 15 to 20 ft. In addition to these creek deposits, there are bench gravels of Pliocene age. These constitute the celebrated White Channel, an older deposit, through which the present valley has been eroded, with enrichment of the creeks by concentration of the gold from that older deposit. The bedrock of this White Channel is 195 ft. above the surface of Bonanza creek; the greatest vertical thickness of the deposit is 110 ft., and the biggest horizontal width of gravel is 1200 ft. Several of the hillsides expose gravel-beds 800 ft. wide for a vertical height of 40 to 45 ft. The longest face on any one hill is 4000 ft. Each lateral gully and tributary entering Bonanza has cut into the White Channel, enriching Bonanza creek at that point, but cutting a hole in the bench gravel. The engineers estimate that they have 47,000,000 cubic yards in the White Channel, and the yield is estimated at 32 cents per yard. Actual tests have given returns ranging from 30 cents to $2.30 per cubic yard. The deposit is easy to disintegrate when once thawed; when hydraulicking begins, with ample water under heavy pressure, a duty of 5 cu. yd. per miner's inch may be expected. In order to obtain room for the tailing discharged from these hillside operations, it was necessary to control the creek claims. This has been done; and as they become worked out, by dredging and other methods, the tailing from the White Channel will be discharged upon them, until the hillsides and valleys are a gray desolation, on which the Arctic moss will eventually spread a protecting cover, as before the irruption of man into this northern wilderness.

The Yukon Gold Co. now controls the ground made famous by the Klondike rush, and is ready to conduct operations on a large scale. About $11,000,000 has been spent in equipment and purchase of ground during the last three seasons; an electric power-plant, a 70-mile ditch system, seven dredges, sundry reservoirs, several pipe-lines, and all other requirements for alluvial mining in a systematic manner have been completed. Next year will see the beginning of large operations, which are certain to be productive and profitable. This important enterprise has suffered from being associated with a disreputable trickster at Boston, but it is in the hands of clever people, and the technical direction has been given to professional men of recognized ability, so that there is every prospect of results of far-reaching importance. The failure of the Yukon Gold Co. would be a disaster to the mining industry of the North; the success of it will stimulate other operations on a large scale. Success seems assured.

While the Yukon Gold Co.'s work is much the most important undertaking in the district tributary to Dawson, it must not be supposed that these operations include all the local activity. On the south side of the Dome, and even on the northern watershed, so largely dominated by the Guggenheim holdings, the alluvial mines are producing gold and they will continue to do so, but it must be confessed that the possession of water-power and the control of the major portion of the room available for tailing will give the Yukon Gold Co. an opportunity to acquire most of the rich ground on the north side of the Dome. This has annoyed, and will further annoy, many good people who dislike the too complete dominance of a single concern. However, it will enable many claim-holders to dispose of their property at a good profit, and it will distribute money among men who will thus become equipped for further exploration in the surrounding wilderness. Every large

mining company acts as a feeder for local enterprise by affording the capital needed by the individual operator, whether that capital take the form of large sums received for claims, or wages paid to workmen, or money transferred to local merchants in exchange for supplies.

Outside of the Dawson district, there is activity in dredging on the Stewart and the Forty-Mile rivers. Some of the dredges have done well during the past season and there is encouragement for an extension of this kind of mining; but such favorable comment must be accompanied by a warning lest it lead to misunderstanding. The old blunders, of using machines of light construction, of attacking ground that is partly frozen, of insufficient drill-testing before dredging, and inadequate equipment afterward, are repeated, needlessly and scandalously. There is no excuse for these childish mistakes, the experience now available should obviate the repetition of them, and all who speculate in this form of mining should take pains to apply the lessons of the past for the better illumination of the future. One lesson learned during the last two or three seasons is the hopelessness of trying to dredge in frozen ground—that way lies destruction of the dredge and disaster to the enterprise. On the other hand, the work done by the engineers of the Yukon Gold Co. has proved that thawing with steam is not as costly as was supposed; in ground 20 to 25 ft. deep the expense is 15 to 20c. per yard, and by stripping the overburden of moss and 'muck' this figure can be reduced one-half, so that the method is vastly cheaper than blind butting into a solid mass of frozen gravel, which, even if it be dug by the buckets, cannot be treated successfully in the washing apparatus on the dredge. Another feature of the work done during recent years has been the discovery that along many streams the channel is not frozen, so that dredging can proceed with but little hindrance. This has been the experience in the Klondike valley and on the lower reaches of the Forty-Mile river. It must be remembered that all the early alluvial mining was done in frozen ground, for thawed gravel meant pumping, timbering, and other expenditures anxiously avoided by the Alaskan or Yukoner. Owing to the difficulty of testing thawed ground in the ordinary way by shaft-sinking, the exploration of the deposits most suitable for dredging was delayed until churn-drills were employed intelligently. Drilling is now in progress at many points and a large amount of systematic information is being collected. This will prepare the way for the intelligent application of dredging, elevating, or any other form of placer mining deemed suitable to local conditions.



Map of Alaska.

After U. S. Geological Survey, with additions.

Fairbanks and the Tanana Valley.

The three great mining centres of the North are Dawson, Fairbanks, and Nome; they are so situated as to serve as distributing points for separate regions. Dawson, being just east of the American-Canadian boundary, is a point of departure for the miners in the Yukon districts on the one side and also for Circle, Eagle, and other camps that are in Alaska but near the boundary and down-stream from Dawson. Fairbanks is on the Tanana river, at a point 275 miles above its confluence with the Yukon; this town is the supply point for the entire Tanana valley, and also for the prospectors going up the tribu-

tary streams. Being in the heart of interior Alaska, Fairbanks is steadily gaining in importance; someday it will be a division point on a railroad from the Lynn Canal to Nome—at least, that is what some of its intelligently optimistic citizens assert. Nome, of course, is the port of entry for the Seward Peninsula and the extreme northwestern corner of Alaska, as well as for the Siberian coast opposite.

The first discoveries of gold in the Tanana region were made in 1902. In 1905 the output of gold was $3,750,000; in 1907 it was $7,500,000; and in 1908 it is estimated to have been $9,000,000.

The region tributary to Fairbanks consists of a number of contiguous districts traversed by different creeks possessing alluvial deposits varying greatly in dimensions, depth, and richness. For the most part the gold-bearing channels occupy the beds of open valleys sunk about a thousand feet below the ridges separating them. The gradient is slight, averaging about 100 ft. per mile.

The first discovery was made on Pedro creek, a tributary of Gold Stream. During the last two years this gold-bearing channel has been traced for eight miles down Gold Stream and up the lateral gulches. Cleary creek was the scene of the first big finds and yielded fortunes to many operators; since then the channel has been followed into the Chatanika valley, where deeper mining, by 'drifting,' is required. Similarly, Esther, Dome, Vault, Treasure, and Fairbanks are the names of small creeks flowing along valleys in which gold mining has been undertaken, with varying success. Esther creek in 1908 was one of the best. Thus the name of Fairbanks represents a goldfield covering fully 200 square miles and a score of known alluvial channels containing gold in profitable proportion.

The bedrock is schist and quartzite-schist; it is usually soft, shattered, and easily mined. The gold lies within the crevices of the bedrock and in the bottom layer of the fluviatile deposit. The 'gravel' consists of angular and sub-angular fragments of the prevailing country rock. Most of the gold that is extracted comes from the sediment lying upon the bedrock and from the uppermost portion of that bedrock, at least two feet of it being removed and washed in the sluice-boxes. A yield of $1 per square foot of bedrock uncovered is a fair return for a 'drift' mine that is 14 to 15 ft. deep. Profitable mining has been done, by 'drifting,' as deeply as 150 ft. On No. 4 and No. 5 Below on El Dorado, for example, the pay-gravel is 80 to 90 ft. wide. The portion removed includes 4 ft. of alluvium and 2 ft. of bedrock. I saw pieces of gold weighing over two ounces that had been taken from this ground in July. The local unit is the gravel lying upon a square foot of bedrock. A fair return is $1.50 per square foot, at 25 to 60 ft. deep; the thickness of material extracted is usually 6 ft. and a pay-channel 80 to 100 ft. wide is considered excellent. The gold is coarse, sometimes very coarse. On No. 5 Little El Dorado on August 3, 1908, the clean-up yielded 296 oz. gold, not one-half of which would go through a sieve having apertures of $^3/_{16}$ inch. The largest nugget weighed 10½ oz. Naturally, the cheapest mining, and therefore the most successful, is done where the ground is shallow and completely frozen. In the upper valley of Cleary, for example, at No. 1 Below, the bedrock is found at a depth of 18 ft. A vertical section shows 2 ft. of moss, 10 ft. of overburden, 5 to 8 ft. of pay-gravel. Since 3 ft. of bedrock is mined, the total thickness of profitable material is 7 to 12 ft. This ground is stripped with scrapers and then removed by self-dumping buckets. The Discovery claim, a short distance farther up the valley of Cleary, has yielded over $1,000,000 in four seasons and the bench claim adjoining has given $500,000. On the latter J. C. Smith and his associates took out $20,000 in 32 hours. The remnant of ground remaining is 33 ft. deep and is worked by 'drifting.' Thawing with steam-points at night is followed by pick-and-shovel work in the daytime, aided by a self-dumping bucket, which carries the gold-bearing stuff to the sluice-boxes.

Mining has been confined mainly to 'drifting,' that is, sinking a shaft in the frozen ground to bedrock and then extending galleries underground on top of bedrock. Only recently has there been any attempt to employ the open-cut method systematically. As a rule the bedrock is too deep to permit of open-cutting. Dredging has not been attempted, as yet.

Distance down-stream does not necessarily mean additional depth to bedrock; there are many curious changes of level. A shaft in the Chatanika valley, below the confluence of Vault creek, went down 315 ft. in frozen ground before bedrock was reached. Twenty miles farther the valley narrows and bedrock outcrops in the bed of the stream. For miles the bedrock is then only 8 to 10 ft. deep. On Gold Stream, near the confluence with Moose creek, the depth to bedrock is 35 ft., while above, at the mouth of El Dorado, a shaft was sunk 186 ft. to bedrock. The existence of small lakes, and the low divides between some of the valleys, suggest that erosion and elevation have made important changes in the hydrography of the region.

On several creeks the bedrock is so deep as to tax the miner severely. The bedrock of Dome creek is 60 to 170 ft. deep; on Vault the shallowest mines are 100 to 175 ft. deep; on Treasure, the depth is 180 ft. Even rich ground is unprofitable under such conditions. On Esther creek No. 6 Above shows bedrock at 22 ft., No. 3 Below gets into bedrock at 45 ft., and No. 8 Below at 92 ft.; but the gradient is not regular.

The important fact remains that there is much ground that is 40 ft. deep or less: on Cleary, from 3 Above to 4 Below; on Fairbanks, as far as 10 Below; on Pedro, all the way from Twin creek to 10 Below, where it joins Gold Stream; on Gold Stream as far as 9 Below. More ground of this character is likely to be found when the region is carefully prospected. There are scores of creeks on which no hole has been sunk to bedrock, because the ground is not wholly frozen and is therefore not adapted to mining through shafts. Such tracts have not been tested even by drilling, as yet. A ride on horseback along the dividing ranges in late summer, when such an expedition is practicable by reason of the drying

of the mossy covering of the ground, will suggest to any observant engineer that there remains a wide stretch of untried possibilities within the heart of this almost untrodden wilderness. According to Lucien S. Robe, a resident engineer, there is a spacious region 60 to 125 miles south of Fairbanks where dredgeable gravel 15 to 40 ft. deep is spread; this gravel runs $3 "per shovel," that is, the quantity a man with a No. 2 shovel can move in a shift of 10 hours—about 6 to 7 cu. yd. Such statements are, at least, suggestive. There is a splendid scope for intelligent prospecting in behalf of experienced operators.



On Dome Creek, Yukon.

From a hydrographic standpoint, the Tanana region is badly situated. The creeks drain no lofty mountain range; their watersheds are low hills, on which the snow does not rest in summer. The catchment areas are small. During the summer the creeks are fed by ground-water, derived from the melting of tundra ice. The run-off per square mile of drainage-area was unusually low this year, from 25 to 35% lower than in 1907. Any shower is at once felt in the increased volume of the creeks, because the tundra is in a saturated condition from the thawing of the sub-soil ice. The effect of a shower is temporary. There is no natural storage: the sparse growth of trees is unfavorable to economy of snow or rain, no high mountains furnish resting places



Rudimentary Alluvial Mining in Alaska. This Method is Known as 'Shoveling In.'
Photograph loaned by U. S. Geological Survey.

for snow, and the low gradient of the valleys prevents any hydraulic head being available for mining operations. Under such conditions hydraulic mining is impracticable, and even the construction of long ditches is not to be encouraged. In order to obtain head it is necessary to go up-stream; in going up-stream the flow available decreases rapidly, because the supply comes from ground-water, not from snow-fields at the source. Transmission of power as electricity is practicable, the application of the dredge and the mechanical elevator is worthy of investigation, and the conservation of water is imperative. I shall return to this part of the subject again; the facts to hand emphasize the richness of the Fairbanks region, and the wide area of fluviatile deposits containing gold. If situated in a country less large and less remote than Alaska, Fairbanks would be recognized as one of the great goldfields of the world.

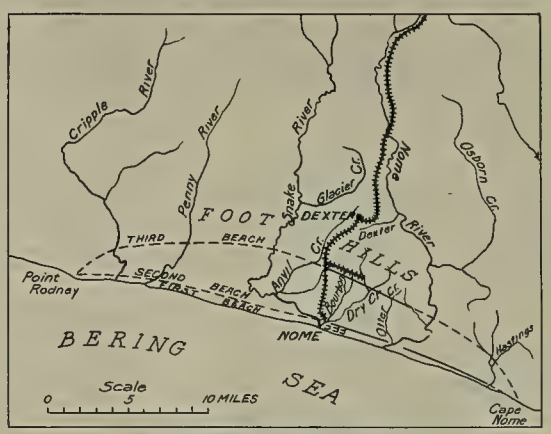
Nome and the Coastal Plain.

Descending the Yukon we reach Bering Sea and cross Norton sound to the southern shore of the Seward Peninsula, where Nome looks westward toward Asia. The first mining was done on Ophir creek in 1897 and the first beach discovery was made in June 1899. Gold had been found by white men as early as 1888, but no mining resulted. The rush to Nome was due to the finding of gold in the sea-beach during the sumer of 1899; the following year saw the stampede. The output of gold from the Seward Peninsula during the ten years since 1898 is estimated at $50,000,000. The maximum was reached in 1906, when the Third Beach proved so productive. Of the total output fully $22,000,000 has come from the sea-beaches, present and ancient. In 1908 production suffered from a scanty water-supply, the precipitation being half the normal, so that only $5,000,000 was extracted.

This is an enormous tract of mining country; the Peninsula includes 20,000 square miles, the major portion of which is mineral-bearing. For the purpose of description the gold-bearing areas may be divided into creeks and beaches. No vein mining of any consequence is being done, the one important mine (the Big Hurrah) having closed down. On the creeks the methods of mining and the conditions of gold occurrence resemble other parts of Alaska, except that limestone and lime-shale often constitute the bedrock, alongside the schist. This harder bedrock modifies the concentration of the gold and influences the cost of mining. On Anvil, Glacier, Dexter, Ophir, and other streams extraordinarily rich placer deposits have been found and exploited successfully. The rudimentary methods of the first prospectors have been followed by open-cutting, the use of the hydraulic elevator, and finally by dredging. An enlargement of the water-supply has been ensured by the construction of several long ditch-systems, such as the Miocene, Seward, Penny, Pioneer, Cedric, Topkok, and Paragon, all of which are fed from a watershed in the high mountains in the central portion of the Peninsula. By aid of this water the stream and bench deposits of gravel have been mined successfully, if extravagantly. The yield has discouraged economy and it is only lately that technical efficiency and businesslike administration have replaced the flamboyant ways of the boom period.

From the fluviatile deposits along the bottom of the gold-bearing streams of the Peninsula there will be much gold extracted, even by re-working ground already exploited by the hasty methods of the first operators, but the chief interest centres on the possibility of mining the coastal plain behind the town of Nome. To understand the character of this deposit, it will be necessary to outline the story of the beaches.

Gold was found in the sand of the shore bordering Bering Sea in 1899 and fortunes were dug by mere washing of the detritus that the tides had concentrated into a fringe stretching for many miles between Cape Nome and Point Rodney. In 1902 gold was found on the edge of the tundra back of the beach and the continuity of a rich deposit of similarly concentrated particles of gold, garnet, and magnetite was proved. This was traced across the



The Beaches of Nome.

tundra for 9 miles in a line nearly parallel to the present shore and was called the Second Beach. A low escarpment covered by the tundra indicates the origin of the deposit, which was worked profitably in a number of mines for a distance of 2 to 3 miles. The gold lay on a false bottom of clay 37 ft. above present tide-water. This stimulated further search, which was now aided by the preliminary reports of the U. S. Geological Survey. In the fall of 1904 the Third Beach was discovered, through the accident of a shaft being sunk in a creek where the beach deposit crossed. This Third Beach lay on a false bottom at 70 ft. above tide-water and an average of 45 to 60 ft. below the present surface. It followed a flat crescent, the horns of which were near Cape Nome and Point Rodney, and thus it marked the line of a former shore. The distance from the present beach to the Third Beach through Nome is 3 miles and the rise is 68 ft. Subsequently an intermediate beach was found, about 1½ miles inland, and 22 ft. above sea-level, but on bedrock. Other deposits of the same nature, but less continuous, have been found. Thus it has been demonstrated that the

coastal plain stretching east and west from the town of Nome is underlain with a series of old marine concentrations of gold-bearing gravel. Of these, the Third Beach has yielded about $15,000,000 and has contained some wonderfully rich spots. From a littoral fringe (now 50 ft. underground) 25 ft. wide as much as $3000 per running foot has been taken for a distance of 110 ft. While the ground was extracted for a depth of 3 ft., the rich pay consisted usually of a couple of inches of the bottom and an inch of the overlying sediment. These beaches cross the present creek-valleys and gullies, cutting across the tundra from the coast range to the sea. Thus Hastings, Dry, Bourbon, and Anvil creeks have been mined, and also the Nome, Snake, and Penny rivers, in all of which placer deposits have been formed by the concentration of gold from the hills to the north and by the concentration of the gravel constituting the coastal plain itself. The question then arises whether the whole coastal plain is not a workable gold-bearing alluvial flat.

The coastal plain is an immense talus spread along the shore of Bering Sea and extended southward as the land has been slowly elevated. Of this geological fact there is ample proof. The source of the tundra gold is the mineralized schist of the foothills that rise above the flats at a distance ranging from 3 to 3½ miles due north of Nome. This is at the centre of the sweeping curve made by the old coast between Cape Nome and Point Romney. The creeks that cross this plain on their way to the sea are richer than the mass of the deposit simply because the amount of gravel has been diminished one-third, while the gold from the third that has been washed into the sea has settled to bedrock. Owing to the clean character of the overburden, the gold has settled, until finally a layer of clay has arrested further descent. Thus it is found on a false bottom at some distance above bedrock. Vertical sections of the deposit have been obtained from bore-holes and shafts. While most of the gold is concentrated toward the bottom, there are enrichments at 10 ft. and at 20 ft., as well as at other horizons. In the creeks a return of 50 to 70 cents for a thickness of 35 to 40 ft. is recorded by numerous drill-holes; on the tundra the depth is 40 to 60 ft. and the sampling indicates a more variable yield, from 25 to 40 cents per cubic yard. Even in the deepest holes the particles of gold are sufficiently numerous to suggest that the whole mass might be worth exploiting.

The richest portion of this coastal plain is from Nome river to Snake river, a distance of 9 miles. Here the maximum width is 3½ miles. At a rough estimate there is here 25 square miles of gold-bearing territory. The depth may be averaged at 50 ft. I shall not make any calculation as to the millions of cubic yards of material existing within these limits, because any of my readers can perform this simple arithmetical exercise for themselves; moreover, it is not likely that the entire area is equally gold-bearing, nor indeed is all of it likely to be rich enough for profitable mining operations. My purpose is simply to draw attention to a most important stretch of gold-bearing country, known to be rich enough to invite systematic prospecting. The facts available at this time warrant the expenditure of money in drilling and in other methods of testing; the information at hand as yet does not justify the launching of big schemes of operation.



Vegetables Grown in the Summer of 1908 at Fairbanks, Alaska, Latitude 64° 51' North.

Any plans to exploit this most interesting deposit of gold-bearing detritus must have reference to the flat slope of the bedrock, the frozen condition of portions of the deposit, the thawed condition of other portions, the covering of moss, and the disposal of tailing. The tundra can be ground-sluiced for the removal of the covering of moss for a cost of about $2500 per acre. If the ground is then drained and the warm summer rain allowed to percolate through the exposed gravel, it may be possible to thaw without using steam-points. In any event, here is a problem and a possibility well worthy of the attention of technical skill and speculative energy.

Mining in the North is hindered by the high cost of transport. The freight rate to Fairbanks from Seattle or San Francisco ranges from $75 to $150 per ton by the two companies that control the river traffic. To Nome the rate is $12, one-third of which is charged for lighterage. In consequence of the high

cost of transport, the wages paid workmen range from $4 to $6 per day, plus board, which costs from $1.50 to $3, according to locality. The operators complain of the high wages and the workmen in the mines complain of the small margin left after paying for the necessaries of life, and the cost of getting into and out of the country. Most of the men migrate at the end of the summer season. This entails economic waste. At Nome it is not so bad, but at Fairbanks the coming and going consume an amount of money and time that is a severe tax on the industry, which pays it indirectly. The cost of mining at Nome is sure to be diminished shortly, for both labor and supplies are certain to be cheapened by the facility of ocean transport, but at Fairbanks no marked decrease is likely so long as the two transportation companies unite in controlling rates and maintaining them at a prohibitive figure. A railroad from Lynn Canal to Fairbanks would change the entire economic aspect of the interior of Alaska.

Lack of water is another drawback. The interior of Alaska is an arid region. Most people are so accustomed to thinking of the country as covered with snow and ice that they do not realize the dryness of the climate. Southeastern Alaska, to which most tourists go, is abnormally wet, the precipitation at Juneau being from 95 to 100 in. per year. In 14 years the rainfall at Juneau averaged 93.7 in. At Fairbanks the rainfall in 1906 was 10.63 in. At Tanana in four years it averaged 15.45 in.; and in 1907, 14.10 in. At. St. Michael the average is between 16 and 20 in. At Nome in 1907 it was 16.69 in., and in the first six months of 1908 it was only 3.49. No wonder the placer miners are short of water, or that it sells for $1 per miner's inch per day. And yet the Alaskan often uses his water wastefully, employing it in hydraulic operations of low efficiency. In many cases it would be more economical to transform the energy of the stream into electricity and transfer this power along a copper wire for use in machinery, such as the dredge or the mechanical elevator. In some cases power can be obtained from the ditches, at their upper end, without severe curtailment of the pressure available at the mine; under such conditions the water, after use on a wheel, could be returned to a lower ditch, undiminished in volume. In a region presenting unusual difficulties to the building and maintenance of ditches, it is cheaper to transmit power as electricity. A wire can be stretched farther and more easily than a ditch can be dug or a pipe laid. The small trees growing in the interior of Alaska will usually provide sufficient poles close to the place where they are to be erected and the climatic conditions are favorable to the maintenance of such a pole line. The average cost of an electrical transmission line conducting 30,000 volts is $1000 per mile, while the average cost of a ditch able to deliver 5000 miner's inches (7500 cu. ft. per min.) of water is $20,000 per mile. At Nome oil is delivered for $2.75 per bbl. By burning this comparatively cheap fuel, transmitting the power to scrapers, mechanical elevators, and dredges, while using the water for washing the gravel, an economic operation is practicable.

The purpose of mining is to make a profit, which is measured by the difference between yield and cost. It matters but little whether the cost is high if the yield be proportionately large. The tendency is to look most favorably on large low-grade deposits, operated at a small cost and returning a steady income; they are preferred to rich deposits because their persistence as ore deposits ensures the life of the industrial undertakings for which they afford a basis. Men have learned that rich mines are short-lived, usually; therefore they anticipate the brevity of an enterprise founded on bonanza ore, until actual proof of big reserves is forthcoming. This is a sensible attitude, for it is justified by experience. On the other hand, low costs do not always spell success, nor do high costs necessarily entail failure. It may be more profitable to use 'steam-points' and dredge at a total cost of 25 cents per cubic yard in one locality than to dredge easy ground for 5 cents per yard in another place; everything depends upon the amount of gold extracted as a result of these operations; a yield of 80 cents in the one case gives a profit of 55 cents, while a return of 15 cents affords only 10 cents per yard in the other case. If this result be applied to the amortization of capital, it becomes possible to appraise the economic attractiveness of the two enterprises.

To those accustomed to other mining regions in which alluvial mining is predominant the richness of the gravels of the North is an insistent fact. The ground worked by drifting has averaged $4 per yard of material excavated, the ground worked by open-cut methods has averaged $2, the ground removed by the hydraulic elevators has yielded $1.25 per yard, and the dredges have averaged nearly $1 per yard; thus the gravel exploited in the North during the last ten years must have yielded $3 per cubic yard. And not more than one-half of the gold was extracted. This is a large statement, but fully warranted. I could quote many cases of ground worked twice, even three times, that yielded as much at the second as it did when attacked in its virgin condition. The yield has been astonishing, but the methods have been crude and incomplete. There is going to be much profitable working of ground deemed valueless under the expensive and extravagant ways of the boom period. To engineers and operators possessing capital, in the form of experience and money, there is offered a splendid field for intelligent endeavor. The mining industry of Alaska and the Yukon is about to enter a new stage.

To deposit copper upon glass, one part of freshly distilled phenylhydrazine is heated in two parts of water until the solution is clear. A warm solution of cupric hydroxide in ammonia is added, followed by a hot 10% solution of caustic potash until a slight precipitate of cuprous hydroxide occurs. If the solution, in this condition, is brought in contact with a clean glass surface, a bright, perfectly reflecting deposit of copper forms upon it. The copper thus deposited is washed in an hour with water, then with alcohol, and finally with ether, in order to dry it without rupture. It is then coated with lacquer or varnish.

SMELTING CONDITIONS AT SALT LAKE.

Written for the MINING AND SCIENTIFIC PRESS
By COURTENAY DE KALB.

Mutual distrust between the smelters and the ore-producers in the West has never been so great as at the present time. The miner has invariably accepted the smelter as a necessary enemy, instead of an ally. The basis for settlement between ore-shipper and smelter is unavoidably complex. In the application of sliding scales, penalties, bonuses, discounts, and direct charges, lie opportunities for over-reaching, which the shipper is prone to call by a harder name. Abuses have been common, but it is certain that they were far more frequent in the old days of cut-throat competition than they are under existing conditions when, speaking broadly, no open market exists. Strenuous efforts to obtain a wide patronage led to such cutting of rates that only by resort to sharp practice was it possible in many cases to win a profit. The miner is disposed to believe that the habit has been transmitted to the great corporations controlling the ore market today. On the other hand, the smelters are forced into greater caution in dealing with the public. They feel themselves under the ban, along with every other great combination of capital. They realize that they are regarded as legitimate prey by all who can benefit through harrassing them in the courts or by adverse legislation. On their side, they believe that the public has acquired the habit of persecution.

The day of the small smelting plant, however, may be said to have passed. With the increase in costs of labor and supplies, metals are necessarily produced on a lower margin of profit than formerly. Only by conducting operations on a vast scale can economies be introduced to meet the changing industrial situation. The spasmodic opening and closing of small plants reveals the practical impossibility of competition with the larger establishments; not only are costs relatively increased, but refining in a small way is economically impracticable. This applies with special force to copper. Before the metal is ready for market terms must be made with the giant corporations. It is a repetition of the ancient story of escaping Scylla to fall into Charybdis.

If the shipper distrusts the large operator, he distrusts the small one even more. He must secure a steady market for his ore in order to prepare for cheap mining; he hesitates to tie himself to an enterprise that may succumb at any moment, and leave him embarrassed for means to meet his obligations. The powerful company always exercises the greater attraction; though it may drive a harder bargain, it can be relied upon to fulfil its engagements. Great combinations of capital for smelting can be fought only with the weapon of combination among the mine operators, and such organizations have so far proved ineffective. They have lacked cohesion; perhaps they have lacked competent leadership; they centainly have never been inclusive of a formidable majority, partly because of wavering conviction among the mine-operators, and partly because the large smelters from necessity have tied many producers by long-time contracts. Moreover, the smelter is a self-perpetuating enterprise, while the lives of mines are usually uncertain. The smelting situation is not unique; it is merely one phase of the industrial revolution taking place in every department of human activity throughout the civilized world.

Salt Lake City has become the most interesting smelting centre in America, and the battle wages there more hotly than elsewhere. It is centrally situated; it is at the cross-roads of commerce in the Middle West; it is surrounded by mineral districts of phenomenal reliability, yielding a great variety of ores, and offering opportunities for mining on a stupendous scale as well as for working profitably with modest capital. Both lead and copper are produced, the same districts containing mines of both metals. Basic ores predominate, and this extends the zone of attraction to Nevada, affording a market for the abundant silicious ores of that State. Large shipments are also made from Colorado to Salt Lake City, and from almost every mining camp in the Rocky Mountains. The conditions for economical smelting are ideal. In addition to the advantages already enumerated, enormous resources of coking coal exist only 125 miles away. Carbon county alone produces more than a million and a half tons of coal per annum, and the output for the State is approximately 2,000,000 tons. Run-of-mine coal laid down at Salt Lake City, Murray, Bingham Junction, and Garfield costs about $3.25 per ton, and slack is available at $2.75. As a result of these exceptional conditions smelting can be conducted at lower cost in the vicinity of Salt Lake City than at any other point in the Western States, and the smelting charges are actually lower than elsewhere. It has been asserted by representatives of both the American Smelting & Refining Co. and the United States Smelting, Refining & Mining Co., that the average net profit on the treatment of ores at their respective Utah plants does not exceed $1 per ton. If this be true, it represents an inadequate return upon the capital invested. There has been active competition between these corporations, which has inured to the advantage of the miners. In spite of this rivalry, complaints are wide-spread, and a friendly understanding between these two companies is generally believed to exist. The circumstance that the United States company ships its silicious ores to the American Smelting & Refining Co.'s plant at Garfield is given as one evidence of such an understanding. At the beginning of the year 1908 great dissatisfaction prevailed throughout the State; it was freely asserted that a working alliance respecting smelter contracts had been arranged between the two dominant concerns. In the nature of things, operating as they were upon a narrow margin of profit, the terms offered on either side could not be materially different. Harrassed as they were by suits for damage from smelter fume, they declined uncontracted shipments, and this spread the discontent. Damage-claims from farmers against the United States company, now in court, exceed $300,000, and similar claims against all the smelting companies in the

Salt Lake valley aggregate fully $1,000,000. The American Smelting company distributed the sum of $40,000 to the farmers as bonuses in consideration for the privilege of operating the lead plant at Murray. The United States company offered to distribute similarly the sum of $90,000 for a like privilege at Bingham Junction; this was declined. A situation is thus revealed that calls for no comment or explanation. It was an important factor in deciding Judge John Marshall of the Federal Court to hand down a decree suspending the injunction against the Bingham Junction plant. He referred in his decision to this difference in the attitude of the farmers toward the two companies. He pointed out that the conditions in the voluntary agreement with the American company were less severe than those which the United States company offered to accept. The Court restricted the smelter to 0.75% sulphurous acid (SO_2) in the gases issuing from the stack, and required the complete removal from the fume of all arsenic, antimony, copper, lead, and sulphuric anhydride (SO_3). This decision was hailed with wild enthusiasm by the citizens of Bingham Junction. Whistles were blown, bells were rung, and the population turned out on parade headed by a brass band. The suspension of this injunction meant work for 750 idle hands, and a monthly distribution in wages of $75,000.

Under these terms the Bingham Junction plant lighted the fires in its lead furnaces, but the copper plant, consisting of six blast-furnaces, five stands of converters, and a large reverberatory furnace, remains closed. The warfare against smelter fume hits the copper industry with particular severity. The Murray plant of the American company is also treating lead ores only, and the Highland Boy smelter of the Utah Consolidated company is abandoned. The building of the great plant of the American company at Garfield was the direct result of the agitation against the smoke nuisance.

Garfield lies 25 miles west of Salt Lake City, at the southern end of the Great Salt Lake. It is fairly remote from the older farming communities. The company purchased large areas in order to form a buffer zone against the agriculturists. The works are sheltered behind the northern spurs of the Oquirrh range of mountains, and the prevailing winds were expected to obviate difficulty with the farmers in the valley. But the "prevailing winds" proved unreliable, and difficulties have arisen. The company maintains a close watch upon the agricultural districts; a force of men detailed for this special duty is constantly observing the condition of vegetation, and taking samples of air for analysis. The region surrounding Garfield looks sufficiently barren to discourage agriculture, but no place seems desert enough to afford a safe asylum for a smelter. The farmer follows, attracted by the ready market, and, according to the smelters, by the hope of extra gains from 'smoke-money'.

The Utah Consolidated, driven out of the valley by the farmers, has sought a retreat on the western side of the Oquirrh range, in Tooele valley. A novel arrangement has been made to avert a clash with the agriculturists. Instead of acquiring 'smoke-easements' on the surrounding lands, the company has bought 1200 acres in the immediate vicinity of the smelter site in Pine canyon, and in addition has secured options on large outlying areas, aggregating over 20,000 acres, which might be subject to damage. Ten per cent of the contract price is paid down, and the company may exercise its options and take title in future by paying the remaining 90%. If the options are not exercised the original payment is forfeit to the owners of the land. This enterprise has been heralded as a new competitor in the Utah field. It manifestly represents an invasion by the Amalgamated Copper Co., headed by John D. Ryan and Thomas F. Cole, and that, of course, means the Standard Oil Company. The construction of the works will be under the direction of E. P. Mathewson as consulting metallurgical engineer. It has been hinted that this is but one link in an extensive chain of contemplated operations throughout the West, including an agreement with Phelps, Dodge & Co., and that it is in opposition to the interests of the Guggenheims. Whatever of truth or falsehood may lie in this, the immediate purpose apparently involves little more than a relief for the Utah Consolidated. This company now transports its ore from the head of Carr fork, in Bingham canyon, by aerial tramway 12,000 ft., to a loading station on the Bingham branch of the Denver & Rio Grande railway. Thence it costs approximately 30c. per ton for freight to the Garfield smelter. The new works across the range will be only 15,000 ft. distant by aerial tramway, so that a large saving in transportation will be effected. In addition, it is claimed that the reduction in smelting costs will be 67c. per ton, yielding a total advantage of nearly $1. The new smelter will be owned and operated by a corporation organized separately from the Utah Consolidated.

The entry of Standard Oil capital into Utah smelting, however, undoubtedly marks the beginning of energetic competition. Whether advantage to the mine operator will accrue, beyond the mere enlargement of his market, is doubtful. It is hard to see how the rates can be much further reduced. The inadequacy of plant sufficient to handle the ores offered is generally conceded, but the large producers are cared for under contract, and the small mines are not to be relied upon for a steady supply. At the beginning of the year a so-called "independent smelter movement" was started by F. Augustus Heinze. This was part of an elaborate scheme to extend the Mascotte adit to the Ohio copper mine, in Bingham canyon, which would then serve for drainage and transportation; to build a concentration works, and smelter; and to construct an electric railroad from Salt Lake City to Bingham, utilizing the Mascotte adit as part of the route. Funds were secured by a bond issue of the Bingham Central Railway Co., underwritten by the Metropolitan Trust Co. of New York. The issue was for $3,000,000, in 40-year 6% bonds, redeemable in 1912, at the option of the company, at 105. The Mascotte adit has just tapped the workings of the Ohio mine, and the concentrating mill is being built, but Mr. Heinze has not become a factor

in the smelting situation. In January the Utah Mine Operators' Association, with John Dern as president, and Lafayette Hanchette, W. C. Alexander, George W. Riter, and Ernest Bamberger, as the executive committee, passed resolutions favoring the independent movement, and as the Association represents 90% of the operating mines of Utah, Mr. Heinze apparently had a fair field. At the same time the Tintic Smelting Co. was busily engaged in the construction of a plant at Tintic, with a capacity of 400 tons of lead ore daily, and promises were made of a 48 by 108-in. copper furnace later. The plant was erected at a cost of $250,000; was blown in during the first week of August; and after a brief campaign of two months was blown out, owing, it was claimed, to defects in construction. The Independent Smelting Co. also was organized, and rehabilitated the small Ogden



Smelter of American Smelting & Refining Co., at Garfield, Utah.

smelter, which was blown in early in July. This is being operated as a custom plant. The Yampa smelter, in Bingham canyon, began the installation of a two-stand converter plant last summer. It is now treating about 700 tons of ore per diem, of which 200 tons represent silicious ores from Nevada. The Yampa Smelting Co. is a subsidiary corporation of the Tintic Mining & Development Co. The plant comprises two blast-furnaces, and three reverberatories, with converter equipment now in operation. The construction of the third reverberatory furnace, and of the converter plant, was undertaken in the face of an increasing number of damage suits by farmers. Complaints were filed affirming injury from fume 10 miles distant from the works.

The Utah rancher enjoys an independent position. He was there before the smelters; and while he appreciates in a measure the active demand for his products that increased local population causes, he could exist without the smelters. Any man in the arid West owning good land and water rights, and having available such avenues to market as lead out of the Salt Lake valley, is not easily touched by any metallurgical argument but the one of golden coin. He can raise alfalfa and make a good living, and he knows it. The shortage of smelting facilities in Utah today is due primarily to difficulties over smelter fume. The damage done has been grossly exaggerated; but the erection of smelting works in the centre of a rich agricultural region was certain to lead to trouble. The metallurgical industry of past years in the Salt Lake valley, however, was insignificant beside that which is growing up today. Bingham canyon has within the year taken its place in the ranks of the greatest persistent copper-producing districts in the world. Shipments of ore from that district now exceed 12,000 tons per diem. The vast areas of monzonite impregnated with chalcopyrite and bornite, lying close to the surface, and available by steam-shovel excavation after stripping a small amount of overburden, have introduced entirely new conditions. The Utah Copper Co. alone is sending concentrate to the Garfield smelter yielding 4,000,000 lb. of copper monthly. The Boston Consolidated, with a mill little more than half completed, is turning out concentrate representing nearly 2,000,000 lb. of copper monthly. These merely mark the beginning of the new order. Under the aggressive and brilliant leadership of Samuel Newhouse, who has been the leading spirit in the Boston Consolidated, the Newhouse Mines & Smelters Co. is enlarging the copper industry of the State by developments of great magnitude in Beaver county, where a smelter will soon be erected.

The re-opening of the Ontario drainage adit, which was closed by caving in March, 1905, has given a new impetus to lead mining at Park City, which will become a more important producer than ever before. This adit, started in 1888, intersects the No. 2 shaft

of the Ontario mine at the 1500-ft. level, 15,494 ft. from the portal. It extends thence under the Daly West property, attaining a total length of 25,000 ft. The mines benefited by the adit are the Ontario, Daly, Daly West, Silver King, and American Flag. Developments in the neighboring Alta district indicate that it will soon yield an enormous tonnage of lead ore and concentrate.

In addition to normal growth in the Utah field, through increasing activity in the development locally of great mines, the restriction of operations at the Selby smelter on San Francisco Bay through injunctions obtained by the authorities of Benicia, and the abandonment of the plans for the construction of a great smelter at San Bruno, also on San Francisco Bay, have diverted business to Salt Lake. Opposition by the citizens of San Bruno to the erection of a smelter caused the American Smelting & Refining Co., after expending fully $1,000,000, to remove the machinery and equipment that had been delivered on the ground, to the Garfield plant, where it is now in service. Thus have many circumstances contributed to augment the importance of the metallurgical industry in Utah. The year just past has been one of prosperity for the State, despite the financial stringency, and no other period in its history has been characterized by such activity in the erection of huge plants and in preparations for such enormous production as the year 1908. This is a tribute to the marvelous natural advantages in mineral resources and superior geographical position which this favored State enjoys. The work of the last two years has demonstrated possibilities that only those of keener vision had foreseen. It is now possible to look ahead far beyond the span of a generation. The opportunities for industrial achievement here seem endless. The attention of the leaders in American finance is being centred upon this field. It bids fair in its way to become for the West what Pittsburg is for the East. But a serious problem demands solution. The obstructive tactics that have embarrassed enterprise must cease. The future dominance of the Salt Lake valley as a smelting centre depends upon fostering conditions. If persecution continues, a limit will soon be set to the expansion of enterprise. Smelting cannot be conducted without the production of sulphurous gases, and the utilization of sulphuric acid in such quantity as to consume all that would result from complete condensation of the fume is impossible. Extraction of the sulphur by washing the gases would yield enormous amounts of acid liquors, for which an outlet would have to be provided. This might be done, and the State could afford to grant the free use of the Great Salt Lake as such a receptacle. It would seriously injure no one, unless it might be the manufacturers of salt, and to compensate them would be a smaller matter than for the State to lose the benefit of a normal development of its more magnificent opportunities. To a disinterested observer it appears that sympathetic co-operation is needed. If this spirit shall rule, nothing can prevent the Utah field from becoming the controlling influence in American smelting.

COLORADO IN 1908.

Written for the MINING AND SCIENTIFIC PRESS
By FORBES RICKARD.

While superlatives are not needed in recording the history of Colorado's mining and metallurgical achievements for the year 1908, this year witnesses a steady effort toward progress in the face of adverse conditions, such as low metal prices, lack of new discoveries, and a generally lower grade of ore production.

Statistics will show a decreased production in the last two years of from 30 to 35% in the tonnage of smelting ore handled from local points in the Colorado smelters; the figure is now 52,000 to 55,000 tons monthly, as compared with 80,000 tons smelter consumption in 1906. The Cripple Creek ore supply tends more and more to go to the mills, primarily on account of a lower tenor in gold; in part to better milling methods and the lower treatment charges brought about by the rate war that has been waging among the big mills for some time past.

The tonnage from Cripple Creek this year is probably the largest in the history of that district, though the increasing proportion of mill ore and consequently lower ton-value just about maintains the balance of production at $12,000,000 to $13,000,000 for the year.

Preliminary figures for Cripple Creek's output in 1908 are:

	Gold.	Silver.
United States Mint.....	$10,071,867	$14,843
A. S. & R. Co.	2,015,490	11,667
Totals	$12,087,357	$26,510

Sales of gold and silver bullion made through any other agencies will only fractionally increase this total.

The United States Zinc Co.'s spelter production for 1908 is 6,147,000 lb., at 4.58c., or $281,532.

The diminishing output of silicious ores of a smelting grade from Cripple Creek accentuates an already serious shortage, which obliges the Colorado smelters to look to points outside of the State—notably Deadwood, in South Dakota, and Cobalt, in Ontario—for the silica required in the smelting mixture. Creede and Cripple Creek have been the mainstay for silicious ore since the production of the mines of this State began so largely to take the form of sulphide concentrates resulting from mill treatment. Mining of the silver ores of Creede is proceeding upon so narrow a margin of profit that a decline of two or three cents per ounce in the ruling price of silver might suffice to stop the operation of its principal mines.

The foregoing conditions, added to the fact that Utah and Mexico take care of their own ore production, are reflected in an unsatisfactory smelting situation in Colorado, a situation not attributable entirely to the evils of a monopoly that has grown out of the combination of the individual smelters into the so-called Trust. Some blatant Denver newspapers have attacked the American Smelting & Refining Co. and its methods, but this attack (semi-polit-



Aspen and West Aspen Mountain, Colorado.



Leadville, Colorado.

ical in its inception) has been made in such a way as to distort the facts, and it misrepresents the cause of the mine-owners and mine-operators of Colorado in their relations with the smelting interests.

A notable improvement that has grown out of the necessity for cheaper fuel comes through the erection of a modern and thoroughly up-to-date coal washing and coking plant by the American Smelting & Refining Co., at Cokedale, near Trinidad. With 278 ovens in use, the capacity of this plant ranges between 600 and 700 tons of coke daily. In point of construction this plant embodies several new features connected with the use of concrete.

Of the State as a whole it can be said that there is yet no indication of new districts coming into prominence, though that is always held as a hopeful possibility. While prospecting is being done all over Colorado, it seems that the old-time prospector is gradually disappearing, as the frontier moves northwest.

Concurrent with the exploitation of the mines in the well known districts of Colorado, there has unfortunately been practically no new prospect work going on. As a result the mineral resources of Colorado have been largely impaired; that is, as respects the better grade of mineral.

In the carrying out of the exploitation work of the mines which have been worked for the last thirty years, it has come to be almost a universal practice when the mines fail to pay under the operation of the mining companies themselves that the ground has been sub-leased, and it has been due to the energetic work of such lessees and their willingness to take large chances that new orebodies have been brought to light which, however, as a rule have been of markedly lower grade than were those which were produced under company management. In order that these lower grades might find a market, and driven by dire necessity to make use of every mineral resource which the State might furnish, the American Smelting & Refining Co. has consistently worked to the end of bettering its plants so that it might handle the lower-grade ores and still leave a profit for the producer. The history of smelting charges for the last ten years in Colorado will consequently point to an unwavering and continuous reduction in treatment charges which has enabled the production of low-grade material which under other conditions could not have been marketed, especially in view of the concurrent lowering of metal quotations.

Railroad extensions that are active in connection with the Denver, Northwestern & Pacific Railroad, popularly known as the Moffat road, and the Denver, Laramie & Northwestern, are greatly benefiting coal and land interests throughout the country tributary to them. The Yampa coalfields particularly welcome the advent of the Moffat road, which affords them an outlet to the market, for which they have for years been waiting.

Considering the mining districts separately, the one new development of importance is that of the Frank Hough Mining Co.'s mine, on Engineer mountain, in Hinsdale county, where an old mine producing in the years from 1877 to 1885 is being reopened with successful results after long abandonment. The ore shipments carry the extraordinarily high average of 25 to 35% copper, with substantial silver assays, besides gold and lead contents. At Leadville the Ibex company, through lessees, is maintaining the production of last year. The district generally is waiting on the Yak Tunnel extensions under Breece hill. In the San Juan region the Telluride mines are doing well; while from Silverton comes a steady yield of gold and concentrates evincing the usual activity of this district. The Aspen output has been fluctuating widely with the variation in the Smuggler production, which the low silver quotation is holding in check.

The following gives the metal production of the Colorado plants of the American Smelting & Refining Co. for the last three years:

		1906.	1907.	1908.
Tons smelted,		829,426	795,849	555,313
Gold,	Ounces,	466,358	357,558	262,247
	Value,	$9,639,620	$7,390,724	$5,420,646
Silver,	Ounces,	11,345,793	10,749,688	8,398,646
	Value,	$7,576,721	$7,029,221	$4,437,845
Lead,	Pounds,	89,379,381	79,465,000	54,596,000
	Value,	$5,049,935	$4,245,025	$2,298,525
Copper,	Pounds,	8,020,703	9,737,149	12,281,178
	Value,	$1,533,959	$1,947,430	$1,596,553

METAL PRICES.

	1907.	1908.
Silver, cents per ounce	65.39	52.84
Lead, cents per pound	5.34	4.21
Copper, cents per pound	20	13

The rare-mineral resources of this State have for several months been attracting much attention, less to tungsten than to vanadium. From the fact that the Boulder county tungsten production has in recent years taken so prominent a place as to account for nearly 80% of the production of the United States, and approximately 30% of the world's tungsten product, this mineral resource has been well advertised; the vanadium mineral resources are comparatively undeveloped and but little known. The extended use of vanadium in high-grade steels is prompting the development and suggesting the utilization of certain deposits of vanadiferous sandstone in the southern part of the State, which, once that the commercial question is successfully solved, represents an ore supply of no small proportions.

This State's resources in the production of rare metals, in tungsten, vanadium, and uranium, is an asset that is destined to figure more prominently in the future than it has in the past.

The stone industry, particularly in the past year, has been making great strides; in the Yule and the Turkey Creek quarries, respectively, there is being mined marble and sandstone that is fast supplanting importations of building stone from parts foreign to Colorado.

Cost of diamond-drilling in the mines of the British Columbia Copper Co., in the Boundary district of British Columbia, during 1906 and 1907 was $1.705 per foot. The average depth of holes was 81.3 ft., and the diameter of the cores was 7/8 in. One carat of diamonds, the average cost of which was $66.46, drilled 111.9 feet.

THE REAL ELDORADO.

Written for the Mining and Scientific Press
By F. Lynwood Garrison.

The word 'Eldorado' has become part of our English vocabulary and is defined by the Century dictionary as "a country rich beyond all precedent in gold and jewels, which the early Spanish explorers believed to exist somewhere in the New World and which Orellana averred that he had found in his voyage down the Amazon in 1540-41. This was soon disproved, but the search was continued down to the eighteenth century, and the name has become a synonym for any region said to abound in the means of easily acquired wealth." Probably few persons are aware of the origin of the word, and that it is derived from substantial fact; that it is not a mere myth connected with the early history of South America. The following narrative, sketching the history of the Eldorado, will serve as a prelude to a description of the alluvial gold deposits of the Cauca valley in the State of Antioquia, Colombia; these deposits constitute a part if not the heart of the district that furnished the gold which enabled the Indians of the Bogotá plateau to carry out certain curious ceremonies that originated the name 'Eldorado.' For the facts of this fascinating story I am indebted to A. F. Bandelier, whose little book, 'The Gilded Man' (Appleton & Co., New York, 1893), contains some of the most interesting data connected with the first Spanish settlements in America. Fact and fable are so often inextricably confused in the history of the Spanish conquest of South America that it is at times difficult to know what to accept as correct. The story of the Eldorado as related by Bandelier has evidences of truth, hence I venture to re-tell it for the purpose of introducing my own story. It must be explained in this connection, that the old Spanish name for the large country now known as Colombia was New Granada, consequently all the old writers refer to the country by this name.

During the years 1525 to 1530 a story was current among the Spanish settlements along the Caribean coast of New Granada and Venezuela that a certain tribe of Indians living in the interior had such an abundance of gold that with it they powdered afresh each day the body of their chief. This legend of *el hombre dorado*, or the gilded man, embellished in the telling, became a kind of wayside yarn, a tavern story never too fantastic to find a host of believers in that age of superstition and ignorance. The word *hombre* was dropped in the course of time, and the term Eldorado as we know it was evolved. The legend was based on fact, but the word Eldorado has to this day been a gilded will-o'-the-wisp to lure the farmer from his plough, the mechanic from his bench, often to misery and destitution, and seldom to fortune. The very word 'gold,' the sight and feel of the precious yellow metal, has for ages affected the mind of man like a potent spell, especially the improvident and shiftless, ever on the alert for riches easily and quickly acquired.

The various efforts of the Spanish to plant colonies on the Isthmus and in western New Granada had but insignificant results until Balboa in 1511 assumed direction of the Colony at Darien. Balboa seems to have heard in some way of a wealthy Indian tribe that lived on the sea-coast to the south and used large 'sheep' as beasts of burden. Prescott assumes that Balboa learned in this way of the riches of Peru, but Bandelier thinks it more probable that this notice refers to the semi-civilized tribes of central New Granada, that carried their salt over beaten mountain paths to the cannibal tribes of the Cauca valley, receiving gold in exchange. The centres of primitive trade were naturally among the more civilized tribes, for they had the greatest number of wants; they were agricultural, and consequently possessed fixed abodes, or villages; in New Granada such centres appear never to have been in a gold-producing district; the more civilized tribes accumulated, by both trade and war, the metallic treasures of the wilder regions about them. The locality where this rich tribe of Indians lived was eventually determined to be on the tableland of Bogotá, in the Province (now State) of Cundinamarca, in the heart of New Granada. These people were known as the Muysca (Chibchas), who lived on the high temperate plateau of Bogotá. As this upland plain could only be reached through narrow ravines, these people were more or less isolated from the surrounding savage cannibal tribes, with whom they appear to have been in frequent conflict. Yet these hostilities did not prevent an active reciprocal trade, and as a consequence gold was accumulated to superfluity by the comparatively civilized Muysca. These people appear to have understood the art of hammering gold and casting it into tasteful shapes, for they adorned with it not only their weapons and clothes, but the interior and exterior of their temples and dwellings as well. The numerous lakes of the plateau were regarded by the Indians as holy places, each one being considered the seat of some special divinity to be propitiated by throwing gold and emeralds into the water. One of these lakes, known as Guatavita, became thus famous as the spot where originated *el hombre dorado*, or the gilded man. This lake is north of Bogotá, on the apex of a conical hill, probably the crater of a small volcano; it is some 8 or 10 miles in circumference, and has a depth of 40 to 50 ft. The Indians living in the immediate neighborhood of this place at one time constituted an independent tribe, which upon the occasion of choosing a new chief observed an imposing ceremony: the new chief being carried upon a chain hung with discs of gold, his naked body having been annointed with a resinous gum and sprinkled all over with gold dust. It does not appear from the narrative that the chief was dusted in this manner each day, or that he habitually wore such adornment. When the chief and his attendants reached the shore of the lake, they stepped upon a raft (*balsa*), and proceeded on it to the middle of the lake. There the chief plunged into the water and washed off his metallic covering, while the assembled company with shouts and the sound of instruments threw into the lake the gold and jewels they had brought with them.

The sacrifice completed, the chief returned to the shore and to the village, where the festival closed with dancing and feasting. This ceremony appears to have died out about the year 1740, when this tribe of Guatavita Indians was overcome and became tributary to the Muysca of Bogotá.

The search for the Eldorado in South America in the early Spanish days was energetic, and eventually led to the settlement of the Bogotá plateau, which is now the capital and centre of civilization of the Republic of Colombia. It is a singular historical fact that the first man seriously to undertake this wild adventure was the new German governor of Venezuela, Ambrosius Dalfinger, of Ulm in Swabia. It may not be generally known that the Emperor Charles V in 1529 leased the Province of Venezuela to the German house of Bartholomeus Welser & Co., of Augsburg, and that many Germans were among the earliest pioneers in South America. They were not then, as today, mere traders, risking little or nothing in the development of the country, but had among their numbers men of enterprise and courage, ready to embark upon expeditions promising adventure and booty. Dalfinger's hunt failed of its quest, although he reached the edge of the plateau of Bogotá. A number of subsequent Spanish and German expeditions were also disastrous. On the same search in 1536, the Spaniard Quesada started from Santa Marta on the Caribbean coast, and after enduring incredible hardships, and overcoming tremendous obstacles, succeeded in reaching the Bogotá plateau in the early part of 1537. Quesada found the Indians here possessed of an enormous quantity of gold, which of course soon passed into Spanish hands. In August, 1538, he founded the present city of Santa Fé de Bogotá, which consequently owes its origin to man's quest for gold, although it is far distant from any gold-producing district that could have been worked by the primitive inhabitants. With the conquest of the tribes occupying this plateau, was secured the last great treasure of gold that awaited the Spaniards in the New World. Their greed, however, was not satiated by this success, they thirsted for more; then again, year after year, arose like an avenging spirit the legend of the Eldorado, leading other and less fortunate men to a bootless quest into the unknown regions of the interior. In 1534 Heredia started southward into the regions of San Jorge and Sinú, and in 1535 he reached the Cauca river. In this direction went also the expeditions of Cesar, Vadillo, and Robledo, conquering a great part of Antioquia and the upper Cauca valley. Heredia's expedition is said to have yielded to each of his soldiers spoil equivalent to $70,000.

Anyone who has had personal experience in the wilds of South America cannot fail to be impressed by the hardihood, courage, and perseverance of these old Spanish and German adventurers; nothing daunted them; they had no quinine to check the awful fevers in jungle and swamp; no netting protected their bodies from the nerve-racking mosquito; medicine and surgery were alike crude and rude in that early day; instruments of precision, preserved foods, and all the paraphernalia which we now think indispensable for expeditions of this kind were unknown to them; they suffered, usually failed, often died of hardship; some expeditions returned with less than half of their original numbers. These men of iron were brutal and avaricious toward the natives, killing and robbing them without stint; their sins we hear much about, but it is impossible for any fair-minded man to withhold from them admiration for a bravery and steadfastness unsurpassed in the annals of gold-seeking. Success meant for them castles in Spain, but to few were such vouchsafed. After the accumulated stores of gold were taken from the Indians, the Spaniards naturally sought to find the source of these rich treasures; this was soon determined to have been chiefly the alluvial deposits in the valleys of the Cauca river and its tributaries. To wash this gold required hard work, which the Spaniards themselves would not or could not do, hence arose a gradual enslavement of the Indians for this purpose. An overmastering desire to get rich quickly and leave the country was not compatible with kind and humane treatment of the natives, hence they were literally driven to death by their masters. It is stated on good authority that so great was the mortality among the Indians that whole districts were depopulated, causing an abandonment of the mines in many places and a rapid decrease in the production of gold. For two centuries the Indian tribes were compelled to give one-seventh of all their able-bodied men to work in the Spanish mines in slave-gangs. Efforts were made to replace these Indians with negro slaves from Africa, but the experiment does not appear to have been successful, although unquestionably there was a large influx of negroes, as evinced by the present predominant type of inhabitants to be found in the lowlands of Colombia.

The Copper Queen Co. is probably the lowest-cost copper producer in the United States today, which would indicate that its copper costs are not above 7c. per pound. Its smelter is now producing at a rate of better than 8,000,000 lb. of copper per month, or 96,000,000 lb. per annum, though a portion of this production represents copper from its Mexican properties. It has been the policy for some time to pay an annual dividend of $17 per share, which calls for the distribution, as profits, of $3,400,000 per annum. There are 200,000 shares in this company, par value $10, and there are but 14 stockholders, all connected with the Phelps-Dodge firm. The following is a complete list of the Phelps-Dodge companies: Copper Queen Mining Co. of Bisbee, Old Dominion Copper Mining & Smelting Co. of Globe, Detroit Copper Mining Co. of Morenci, Moctezuma Copper Co. of Nacozari, Mexico, Indiana Sonora Copper Mining Co., of Cananea, Mexico, Almagre Copper Mining Co., United Globe Mines of Globe, Arizona, Commercial Mining Co., Dawson Fuel Co., Dawson Railway Coal Co., Stag Canyon Fuel Co., New Mexico Fuel Co., El Paso & Northeastern R. R., Alamogordo Lumber Co., and Southwestern Mercantile Company.

MINING IN THE MALAY STATES.

Written for the MINING AND SCIENTIFIC PRESS
By E. SEABORN MARKS.

The Federated Malay States are situated in the southern part of the Malay Peninsula, which extends from Lower Burma to Singapore. The country is little known to the world at large; nevertheless, it produces over 60% of the world's output of tin, besides exporting rubber, coffee, copra, and other tropical produce. Mining has been the staple industry for hundreds of years, and up to recent times has been mainly in the hands of the Chinese pioneers. It is to this race that the prosperity of the Peninsula is due, while even at the present time it is estimated that fully 85% of the yearly production (amounting in round figures to $39,000,000) is contributed by Chinese enterprise and labor.

The Federated States of Perak, Selangor, Negri, Sembalan, Kelantan, and Pahang are ruled by the rajahs of the original people, the Malays. The country is under British protection, the general policy being directed by the British Colonial Office, represented locally by a Resident-General, residing at the capital, Kuala Lumpur, and under him there is a British-resident for each State. There is a Mines Department under the direction of F. J. B. Dykes and an efficient staff of engineers. This is a Federal institution; it controls the industry, safeguards individual rights, and is the most important government office in the country. A rental of 56c. per acre is charged for mining land, for leases that are issued for a period of 21 years, but renewable in perpetuity. A tax of 10% is levied on the gross value of the tin produced; this also varies slightly with the market price of the metal.

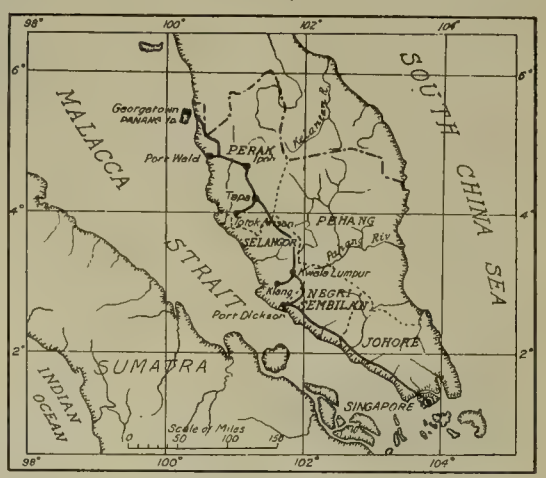
The funds obtained from this and other sources are spent entirely in developing the country by aid of roads and railways, besides generally advancing the interests of the community at large; the surplus stands to the country's credit and at the present time amounts to about $50,000,000. There is a line of railway running from the northern end of the States to Singapore, the most southerly portion of the line through the State of Johore being under construction and nearly completed. The wagon-roads are well built and maintained; this makes it possible to travel pleasantly by automobile.

The climate is tropical, the temperature varying but little during the year, day or night, and the air is heavily laden with moisture. The thermometer stands as a rule between 80 and 90° F. in the shade. Rainfall is heavy, averaging 100 in. per year; in consequence, the country is covered with a thick, inpenetrable jungle, making it impossible to leave the roads or paths without cutting the underbrush. Under these circumstances, prospecting is both arduous and difficult; nevertheless, new mineral deposits are continually being discovered.

The native of the country is the Malay, formerly known as a pirate. Under British rule the natives now lead a quiet and peaceful life, in their *kampongs* or villages; they never work unless it is to cultivate rice and grow a little fruit, besides fishing for their immediate wants. The Malay language is spoken universally by everyone and is the business language of the country. The Chinese, speaking different dialects, use it among themselves, and the European uses the language with either Malay or Chinaman. It is absolutely necessary, therefore, for anyone wishing to do business in this country to learn Malay; but this is easy.

The Chinese now outnumber the Malays. The white population is small but slightly on the increase, with the introduction of more scientific methods in the general industries of the country. This is not, however, a white man's country, as fever and other tropical ailments are prevalent, but with a periodical change to more temperate zones the European can retain fairly good health.

As has been previously stated, tin mining is the staple industry. The methods generally adopted by the Chinese are primitive, of course. Improvement is, however, evident. Today a mine worked on or-



Federated Malay States.

thodox Chinese lines may be seen side by side with the latest Australian mining practice.

A little gold is found in Pahang and Kelantan, but it does not amount to much; tin is practically the only mineral produced. It occurs in the form of cassiterite or tin oxide, which is found for the most part in alluvial deposits. Although placer mining predominates in the State of Pahang, the Pahang Consolidated operates what is probably the largest and richest tin lode in the world, the mine being equipped with an up-to-date stamp-mill and concentrating plant; electrical power for all purposes is generated by water. One or two small lode mines also exist in this State; in fact, the whole of the eastern side of the peninsula divided by a ridge of mountains is reputed to contain deposits of tin-bearing rocks, which in the future will doubtless be prospected and worked. Reference is directed to the tin lode deposits in Sidney Fawns' book, 'Tin Deposits of the World.'*

The main scene of activity is in the western States

*Published by the *Mining Journal*, London, 1907.

of Perak and Salangor, where the mining is confined to placers. From time to time gash-veins have been opened up with a great flourish of trumpets, but no lode of persistent value has been discovered. Nor are the alluvial deposits uniform in character. Tin has been accumulated in the ordinary way in the river-beds. Lacustrine deposits also exist showing water-worn wash, and accumulations of angular to sub-angular detritus, besides alluvial clay that carries tin in places.

Fawns, in his classification of the deposits, refers to alluvial 'deep leads.' In the true sense of the term, none of these has been found, there being no regular leads or runs of tin gravel. The nearest approach to a lead might be seen in the property of the Tronoh Mines, but this is probably a depression in the limestone about 150 ft. wide and 2000 ft. long, and from the shape alone this might be taken for an alluvial lead.

Unfortunately no detailed geological survey of the country has been made, nor does there appear to be any definite theory as to the origin of the tin accumulated in the alluvial deposits. The predominating rocks are granite, schist, and limestone. The granite is locally reputed to have been the matrix, but there is no direct evidence of this, and it would appear as likely that the schist had furnished a considerable portion of the tin.

The tin-bearing area of the two largest and most important districts, Kuala Lumpur and Kinta, have a bedrock of limestone exclusively. The huge holes and pockets, often 200 ft. deep, and the surface generally of this limestone has been entirely covered with tin-bearing débris. The Kinta field, the larger and most important, is fully 12 miles wide and about double as long. Near the town of Ipoh small pipes of tin ore occur in the solid limestone itself. This is a rare occurrence. An article appearing in the *Journal of Geology* entitled 'The Tin Deposits of the Malay Peninsula, with Special Reference to Those of Kinta,' by R. A. F. Penrose, is worthy of reference.† A few English companies within recent times have started operations, but it is only within the last few years that men of experience and talent have directed the work; it has not been unusual to find a white man working with the same methods as the Chinaman.

In the lowest rung in the scale of evolution of Malay mining, we have the interesting Chinese *lombong* or open-cut, illustrated in Fig. 1. Everything is done by hand labor with the exception of pumping the water from the ground. In all cases steam-power or gas-producer plants are used for pumping. The method of mining the ground is as follows: An excavation is made and light bamboo trestle stagings are built at different heights and angles to the face of the ground in the direction in which it is to be worked; the coolies travel backward and forward across these trestles, dumping the overburden on the ground already worked and carrying the *karang* or pay-dirt to the concentrators. The mode of carrying the material is that usual to the Chinese: A pole borne on the shoulders, with a basket hanging at each end, enables the coolie to carry 30 to 40 lb. on each trip, the distance being about 150 ft. A mine worked in this manner resembles an ant-heap. The biggest mine thus operated carries a face 2400 ft. long and 4000 coolies are engaged. Out of every hundred coolies employed, 60% carry, and 40% break the ground and load the baskets; one tool only is used, called a *chonkal*. It resembles a hoe and does the work of a pick and shovel.

The method of concentrating is equally primitive, but more effective. The pay-dirt is dumped into a washing-box to which it is fed with a rake; this box is called a land-chute, and is illustrated in Fig. 2. The box when empty resembles a coffin in shape. It is from 10 to 14 ft. long and at the head would be about 2 ft., widening to 3 ft. 6 in. or even 4 ft. in the first 5 ft. of its length, and drawn in at the bottom to about 1 ft. 6 in. A riffle is placed every three or four feet, there being not more than three riffles to a box. A water supply is provided in quantities as required, and the grade is usually about 1 in 20. To concentrate in this box as the material is raked in, a coolie keeps dragging the gravel against the current with a *chonkal*, and as the concentrate is collected in the riffles, it is dug out and re-treated in a similar box, but without any riffles. From 300 to 500 lb. of the rough concentrate is cleaned at a time. The operation when completed results in an ore assaying from 65 to 72%; this is bagged ready for market.

The Chinese are exceedingly clever in the manipulation of these boxes and the loss of tin is small. The tailing from the re-dressing was mostly black sand and was found on assay, from different mines, to yield from 1 to 5% tin. When the quantity of black sand remaining is taken into consideration, the loss in the operation is small. The mine and concentrating works are under one manager, who sits most of the day in his office. He deputes his work to *kapalas* or foremen, each of whom has charge of an insignificant number of coolies. The mines are worked by Chinese companies or individuals, but principally by the individual, who is generally a rich and influential man. He is called a *towkay*.

The method of working is simple and primitive, but when it comes to paying for the work, the arrangements are intricate. The mines are worked on the 'truck' system, under which laborer and miners were sweated, in the first part of the nineteenth century and before, in England. It is a point which is being contested at the moment among the Malay States Government officials, as to whether Chinese mining would be equally prosperous and the coolies better off if this system were abolished by law.

The Chinese employer settles with his coolies every Chinese New Year and again in six months, there being therefore two pay-days per annum. All the coolies are housed on the mines in sheds suited to the climate and fairly clean. Each clan, or Chinese speaking a different dialect, is kept apart in what

†Abstracted by the author in *The Engineering and Mining Journal*, June 20, 1903.

are called *kongsis* or companies. This is to prevent, as far as possible, any conflicts. Feuds generally exist, but rioting is not frequent, although the coolie has a lot of time on his hands, only working six hours per day. Food is supplied in the shape of rice, and every six weeks there is a feast-day, when extra rations of pork and vegetables and perhaps some cakes are supplied. Pork is generally eaten at one meal each day, the coolie supplying the meat himself.



Fig. 1. A Chinese Open-Cast Mine.

There are few day laborers, the work being performed mainly on contract. On some mines indentured laborers are employed. Charles M. Rolker has published details of contracts.‡ A man takes a contract and has a party of coolies to work with him. The mine-owner deals with the one man only. Any coolie can draw an advance on account of his wages, which are due at the end of six months, but should he make a draw he has to pay interest. At the end of the first month he pays only 30% in other words, he receives 70 cents and is charged with one dollar. In the fifth month the interest is reduced 5%; thenceforth there is a reduction of 5% each month. In the sixth month the *towkay* magnanimously pays him his money with no interest charged. Attached to all the mines there is a store (where all the coolies have to deal), opium dens, theatres, and houses of pleasure are all provided by the genial boss; in these places the coolie is further bled of his earnings. This sounds terrible to anyone who has not lived in the country. It is, however, surprising to find how happy and contented the coolies are; their average earnings are about 25 cents per day, out of which some of them provide themselves with all sorts of luxuries, and save money as well, and in their turn become *towkays*. It is a rare occurrence that a principal fails to meet his obligations; when this has been known, the non-payment of wages creates little fuss or bother; the coolie stoically takes the position as he finds it, says it is fate, in all probability burns a joss-stick or two to propitiate the evil spirits occasioning the bad luck and moves on to find work elsewhere.

Should the *towkay* not wish to feed his coolies, this is done by the contractor, who, while working with the party, takes a small percentage of the money earned besides the share coming to him for his labor, and in turn looks after the catering. On the termination of the contract, an account of the cost of living is prepared and the balance is divided among the workers. Should this plan be adopted, the contractor, on taking his contract, receives the sum of $3 per coolie he is to employ. He has, however, to give a guarantee for this advance, and is charged no interest, the amount being taken into account as against the contract. The cost of mining under the foregoing conditions varies: a contract is let at a price per *chang* equal to 30 by 30 by 1½ ft., or 50 cu. yd., an average price being $4.17 per *chang* for stripping and dumping 150 ft. back from the working face, or 8c. per cubic yard. The pay-wash is contracted at $5.25 per *chang* delivered at the land-chutes. The cost of washing, etc., varies greatly, ranging from 10 to 20c. per yard. The expert coolie on the land-chute gets 50c. per day and the ordinary laborer 25c. and rice. The value of the ground being worked in the big mine previously referred to, is 4 lb. black tin per cubic yard. This mine has produced in the last three years 41,000 *piculs* of 70% ore (16.8 *piculs* equal to one long ton) of a gross value of $895,000, the net profit being $366,000. The working cost, in this case, therefore, represents 60% of the gross value.



Fig. 2. Chinese Sluice-box in Operation.

‡*Trans.* A. I. M. E., Vol. XX. 'Alluvial Tin Deposits of Siak, Sumatra.'

A Chinaman estimates that with his methods of working he can treat ground 40 ft. deep from top to bottom, including 10 ft. of pay-dirt on the bottom, the 'pay' being worth 10 *piculs* per *chang*, equal to 6.66 lb. per cubic yard, or an average from top to bottom of 1.66 lb. black tin per cubic yard.

The foregoing describes a mine working with a free wash; when there is 'puggy' wash or clay, the primitive method of treatment is as follows: the overburden is carried and dumped as before; the pay-dirt is puddled by hand on the bottom of the mine by coolies; sufficient water is added from time to time to form a liquid paste, which is ladled up the face of the claim into troughs placed from four to six feet, one above the other, until it passes into the land-chute, where the contents are extracted in the ordinary way. A mine working on this principle is shown in Fig. 3. This mine produces about 200 *piculs* of concentrate per month and the working costs are about 25c. per yard.

The method adopted to ground-sluice a bank 15 to 20 ft. high is amusing. Fig. 4 illustrated this method, known as a *lampan*. From the photograph it will be noted that the face of the tin-bearing ground is cut in steps or else has an incline of about 70°. A row of coolies starts at the top of the incline and with a long broad-headed spear cuts steps about a foot deep to the bottom. The material broken in this operation falls to a tail-race below, is sluiced away, and the tin collected. On the return journey up the face the coolies destroy the steps they cut in descending; on arrival at the top, the incline is again ready for a further series of steps to be cut, to be destroyed again, and so on, the process being continued. The work is supervised by an overseer, who sits under an umbrella and smokes a water-pipe.

Where a small head of water is obtainable, there a bamboo pipe-line, a canvas hose, and a brass nozzle will represent Chinese hydraulic mining.

But there are also large hydraulicking plants, washing away the sides of the hills; these have pipe-lines from four to ten miles in length, notably at Gopeng and Bruseh, which are English-owned mines. The latter is of interest; it is under the supervision of a Californian engineer and is the biggest hydraulicking mine in the Peninsula, and, when the conditions of working are taken into account, it ranks as a cheaply worked mine. A pipe-line seven miles long supplies water under a head of 350 ft. to three monitors using 3-in. nozzles. The hydraulicking ground is 300 ft. wide and 150 ft. deep. The formation is a tough and fine-grained sandstone, resembling a schist, in the bedding of which are segregations of quartz carrying tin ore. The formation looks like a lode. The face is T-drifted and three or four cases of dynamite exploded at the ends; after each explosion the monitors get to work washing away the débris, while battering and breaking the lumps of rock against the face. A ground-sluice leads to a sluice-box fitted with angle-iron riffles 350 ft. long, 4 ft. wide, with a grade of 1 in 24. As may be imagined, much time is taken in cutting up the bottom; the mine, however, produces 600 *piculs* of concentrate per month. The boxes are cleaned up every three or four days; this takes three hours. The greater portion of the tin is collected in the first 40 ft. of the box, water being supplied at the rate of 750 cubic feet per minute. The ground carries one-third of a pound of black tin per cubic yard; this is equivalent to 11c. The total working cost is 6c. per cubic yard. Added to the difficulty experienced in the hardness of the ground, there is not a good get-away for the tailing, which is raised by a hydraulic elevator and carried farther down the valley, when the accumulation at the end of the boxes has become excessive.

The first improvement in open-cut mining was introduced only within the last few years; I refer to mechanical haulage. An inclined tramway operated by a steam-winch is run from the dressing-floors to the bottom of the mine. At the bottom of the mine tracks run to different parts of the face, where the trucks are filled by hand and pushed by the coolies to the station to be drawn to the surface. This naturally reduces the labor. With the improvement in the method of hauling we find a corresponding betterment in the dressing-plant. In free ground the wash is tipped into a hopper, and then passes to a long sluice-run fitted with riffles. Should the wash contain clay it is dumped into steam-driven puddlers with bottom-discharge overflowing into a sluice-run. To expedite puddling with very stiff clay, a rotary machine treats the material before it passes into circular puddlers. The concentrate in either case is cleaned in a land-chute, and it is doubtful if this latter method could be improved upon locally. Working under these conditions, the costs vary from 15 to 20c. per cubic yard.

In some of the rich placer deposits the Chinese have resorted to mining by shaft-sinking, but this method is not much in vogue, being slow and expensive. The plan is to sink innumerable shafts side by side; the Chinaman will not work away from his shaft, in drifts. The method is also wasteful, a considerable portion of the ground remaining standing between the shafts. In the early days of mining the Chinese for the most part only worked with shafts, and localities formerly riddled with shafts are now being re-worked at a profit. More advanced methods are now adopted in the Malay States, and each year sees some slight improvement, it being recognized that the exhaustion of the richer deposits necessitates increased economy.

In Kelatan there is a fleet of dredges, with buckets of 4½ cu. ft. capacity, of the New Zealand type, digging for gold. These machines are poorly designed and badly operated, according to all accounts, and the industry does not amount to anything. An 8-ft. bucket-dredge with a hull on the lines of an ocean-dredge is working the sea-bottom of the harbor at Tonkah; this plant is said to be doing good work, sea-water being used in the concentrating. It is a private enterprise and no details are forthcoming as to the results achieved.

The most recent innovation has been the advent of a pump-dredge from Australia. The pump-dredge,

that is, hydraulic elevating and sluicing with centrifugal pumps, was started some 15 years ago in Victoria, Australia, working for the most part such ground as could not be treated with a bucket-dredge. This has become an important industry in Australia on the old gold and tin placers. The device may be described as follows: There is a square-built pontoon or barge of dimensions to suit the plant it has to carry. The structure requires to be strong and stiff enough to bear the machinery, and is braced accordingly. In this it varies from the bucket-dredge pontoon. On the barge at each forward corner are placed pumps, to raise water and gravel, respectively; each pump is driven by a separate engine of sufficient power to do the work required. Besides the engines and pumps there are the necessary boilers and accessories and a small electric-lighting installation. This is all the machinery required on a steam-driven pump-dredge. The plant when at work always rests on the bottom or bedrock, and is floated only when the position has to be changed. The intake of the gravel-pump leads to a sump in the bedrock, and the outlet or discharge is through a pipe to a series of sluice-boxes placed above the barge at such a height as may be required according to the depth of ground worked. The sluice-box is from 100 to 150 ft. long and has a fall of about 1 in 20. Water from a ditch on the bank is conveyed to the monitor-pump and is forced through a pipe-line to monitors, which break down the ground, the water sweeping the materials along a flume to the gravel-pump, which elevates the gravel to the boxes, for washing; the tin is extracted and the tailing stacked behind the plant. Rough bouldery ground, with hard rock-bottom that a bucket-dredge could not touch, is successfully worked by this plant.

While in operation, the plant rests on the bottom; this helps when cleaning the crevices and scraping the bedrock. Big boulders are not handled, but may be turned over, so as to get at the surface underneath. A dredge of this kind will work for six months at a time and continue in operation without being moved, stripping several acres. When the working-faces become too distant from the gravel-pump, the barge is floated up to them by flooding the pit; when a desired position is reached the water is pumped out and the dredge rests on a bed prepared for it. Work is then re-started and the ground previously excavated is filled in with tailing. Ground when worked in this manner is left much in the same condition as it was before it was touched, and is not destroyed like that turned over by a bucket-dredge, for the reason that most of the fine and light sand remains on the surface; therefore, under this system there is no destruction of land, watercourses, or river-channels, as may be the case in other classes of hydraulic mining. The water can be filtered should it be desirable to run it away clear, or else, as is at times practised, is used over and over again. The cost of mining varies with local conditions, from 6 to 14c. per cubic yard, the chief item being the power required to raise the gravel. The wearing parts are in the gravel-pump liners. These are made of manganese steel and have to be renewed from time to time. In places, in very deep ground, pumps are worked in stages, one above the other, the lower pump lifting the gravel to another, which raises the gravel to the sluice-boxes.

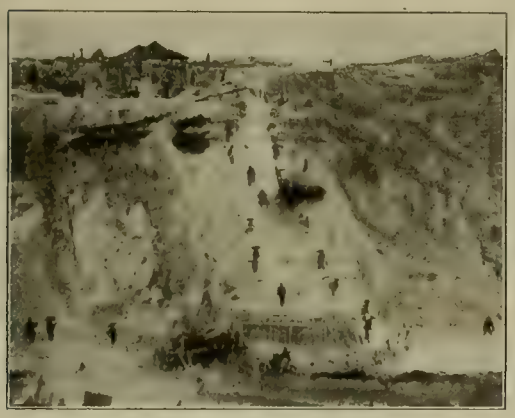


Fig. 3. Working a Deposit of Clay-Wash.



Fig. 4. Chinese Ground-Sluicing.

One of the largest plants in the States is at Tanjong-Rambutan. This has a 15-in. centrifugal gravel-pump, taking boulders of 15 in. diam. It weighs 18 tons and is capable of lifting 2000 yd. of gravel, plus the necessary water for washing, per day. The lift is 50 ft. A 12-in. monitor-pump is used and the compound-condensing engines develop 500 hp. The sluice-boxes are 120 ft. long, 9 ft. 6 in. wide, and 18 in. deep, fitted with a riffle or block 6 in. high and 1½ in. wide every 20 ft. This box has been found by experience in Australia to be more efficient than one fitted with riffles for its whole length. Coolies are kept in the box raking up the stuff all the time. The rough concentrate is cleaned in a land-chute; in Australia, this is jigged. This ground is unsuited to bucket-dredging. The working cost, including all charges, is 8c. per cubic yard.

The Teka plant has two 15-in. gravel-pumps and no monitor-pump. This plant was started recently and the working costs are claimed at 6c. per cubic

yard. The pumps treat 4000 yd. of gravel per day.

At Lahat there are three 15-in. pumps driven by electricity generated at a central station on the mine. The ground is 120 ft. deep and two lifts are used for elevating the gravel to the boxes. These plants have only started work within the last four months.

The details herein given are offered as a description of the various methods of mining in vogue in the Federated Malay States. There is little to be learned from the Chinese, unless it be perseverance and energy. English capital is being invested in the country and with it are coming more advanced ideas. The dark ages of Malay mining are past. The future prosperity of the country will depend upon the exploitation of the low-grade deposits on a large scale by mechanical methods.

PROGRESS IN BRITISH COLUMBIA.

Written for the MINING AND SCIENTIFIC PRESS
By GEORGE A. OHREN.

Looking back over the twelve months of 1908, one may easily discern that the mining industry in southeastern British Columbia has progressed. The year dawned upon a dark outlook; the copper mines of the Boundary were closed down; there were rumors that the Le Roi mine, at Rossland, would stop work; furthermore, the probability of the Dominion lead bounty ceasing in June did not encourage the owners of low-grade lead-silver mines. The work of the Granby Consolidated in the Boundary district, however, cast a ray of light over the situation, and the slight rise in the prices of metals gave hope for much better conditions during the forthcoming months. The Granby company in January was working but half of its regular force, but week after week the ore shipments were augmented, until during the week ending March 22 a record of 27,288 tons was made. While shipments have fluctuated to some extent, the Granby ore production has been steady, and the output for this year will exceed that of 1907 by 400,000 tons. This company has expended $200,000 in improvements in its mining, smelting, and converter plant, and is prepared for a heavy output during the coming year. Following the lead of the Granby, the B. C. Copper Co. resumed work at its mines early in the year, and, after putting in new ore-crushing, air-compressing, and smelter machinery, shipments were begun to the Greenwood smelter in May. The output of the B. C. Copper Co.'s Mother Lode mine this year shows an increase of 100,000 tons, while the shipments made by the Oro Denoro will offset the ore shipped from the Emma last year and exceed it by 65,000 tons. The heavy fixed charges, economical method of mining and smelting, and the general adjustment of conditions making it advisable for the two principal concerns of the Boundary to resume work, it naturally followed that the Dominion Copper Co. should fall into line. In June this company resumed operations at its mines, and a few weeks later blew in the large modern furnace at the Boundary Falls smelter, resuming shipments to that point. The coke shortage, subsequent to the Fernie fire, caused the Dominion Copper Co. to stop work at both mines and smelter. It became known that the company was short of money. Mining was resumed in an effort to keep things moving, but, money not being forthcoming to pay the miners' wages, work was suspended, and a little later on the affairs of the company were carried to the courts. Re-organization is now under way. With the exception of this company, the Boundary mines have made notable headway. The Consolidated Co. opened up the Snowshoe mine in August and began shipments to the Trail smelter in September; in November, there being a surplus of ore at Trail, this surplus was treated at the Greenwood smelter of the B. C. Copper Co. A compressor plant was installed by the same company on the Phoenix Amalgamated property, where active development has disclosed a good body of ore, somewhat resembling that found in the Granby mines which are situated adjacent to it.

The plan of work outlined by W. A. Carlyle for the Le Roi is giving good results, and the mine will show a profit this year, even though the shipments will be about 35,000 tons less than in 1907. The ore sent to the Northport smelter has been of a better grade than last year. The profit won by the Le Roi was greatest in October, when $50,000 was earned. Work on the Centre Star, War Eagle, Iron Mask, Idaho, and Enterprise claims of the Consolidated Co. has given gratifying results; in consequence, the shipments for 1908 will exceed 1907 by over 50,000 tons, and the profits will be proportionally larger. The property has been earning an average of $35,000 or more per month. Two good strikes were made at the Le Roi No. 2 during the year, and that the company has made money is shown by the payment of $1.44 per share in dividends. The development work on the Giant-California has not yet resulted in the finding of ore-shoots. While the Jumbo and White Bear have remained idle, it is expected that money will be available to start operations on these properties early in 1909.

At Nelson, the Silver King mine is once more active. The Queen and Nugget, on Sheep creek, have attracted attention by their profits. Continuance of the lead bounty has stimulated work among the small mines of the Slocan, and the showing this year will be better than for 1907, although the total shipments will show a decrease. This decrease is caused by the inactivity of the Sullivan, La Plata, and other heavy producers of low-grade ore. The Blue Bell mine has been improved to the extent of $200,000 during the year, and can now mine and treat a heavy tonnage of low-grade ore, of which there is a large quantity on the ground. The St. Eugene mine, at Moyie, has shipped 2000 tons more than in 1907, and there is a good lot of ore ready for stoping in the upper levels.

Taking everything into consideration, the local mining industry has improved. The Rossland output will exceed that of 1907 by 10,000 tons, despite the drop in Le Roi shipments; the Boundary tonnage will surpass that of 1907 by over 290,000 tons. The mines are prepared for a heavy output during 1909, and now that the financial trouble and other disturbing factors have been adjusted, a prosperous future seems assured.

SANTA EULALIA MINES, CHIHUAHUA.

Written for the MINING AND SCIENTIFIC PRESS
By F. J. H. MERRILL.

This important group of mines is situated 17 miles southeast from the city of Chihuahua, on a mountain area about eight miles in extent from north to south and six miles from east to west.

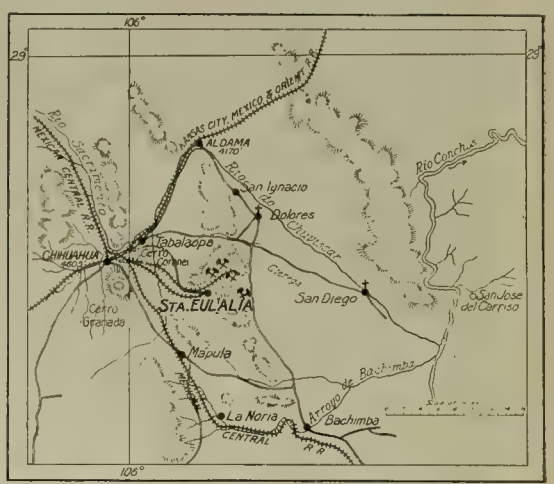
It is traditional that the mineral deposits of Santa Eulalia were worked by the natives before the Spanish invasion; but they were discovered by the Spaniards about 1591 and first opened about 1703. Official records tell us that the older mines of the camp: the Vieja, Aguada, Santa Rita, Santo Domingo, Parcionera, San José, Dolores, and others, yielded an immense tonnage of rich silver ore; this was smelted in primitive adobe furnaces at Santa Eulalia and also at the city of Chihuahua, which owed its early development to these important mines, and at one time supported a population of 70,000, since shrunk to 40,000.

Kimball quotes government records showing a production from 1705 to 1791 of 11,903,126 marcs, or 95,225,008 Spanish ounces, equivalent to nearly $112,000,000; and he estimates the entire production at one-fifth to one-half more than that reported to the tax collectors. The district supported a population of 6000, with 63 reduction establishments, besides several furnaces at Chihuahua. From 1795 to 1800 this region was ravaged by hostile Apaches, and the camp was gradually abandoned. In 1810 began the revolution against Spain, which lasted 11 years, during which Mexican mining generally was at a standstill.

The ore, in the early days, was mainly taken from immense caves, one in the Parcionera, now closed by settling of the ground, being large enough to hold the Chihuahua cathedral. An important feature of these caves was that they afforded storage for the small amount of waste rock that was broken down; so that the oldest openings show no dumps. An additional economy, in connection with the methods then in use, was that some of the old water-channels could, with little labor, be shaped into inclined planes, up which the ore might be carried from the lowest workings on the backs of peons, or even on burros or mules. It is claimed that some of the oldest workings, which were probably operated by natives before the Spanish invasion, were in the southeastern part of the area near the claims now known as La Carlota and El Chiribel. Here the ores contain some gold. It is needless to remark that the mining of those days was on rich ore from the very surface. The first profitable discoveries were on rich shoots or chimneys exposed at the surface, and leading down to connect with the great cave-deposits that made the fortunes of the early mine-owners. These paid so large a revenue to the Government that the cathedral at Chihuahua, which cost $800,000, is said to have been built entirely with the tax money of 1 real (equal to 12½c.) per marc (8 oz.) of silver paid by the mines of Santa Eulalia.

The Santa Eulalia mountain area consists geologically of two principal formations. The lower is Cretaceous limestone, of which about 500 ft. is exposed in canyon erosion and some 2000 ft. has been cut in the mine-workings. The upper is a clastic deposit, partly limestone-conglomerate and partly volcanic breccia and tuff with thin sheets of lava. This has hitherto been generally classed as volcanic, but the base is of sedimentary origin. The limestone is elevated above the surrounding country in the form of a boss or dome of which the central axis, according to Kimball, is near the Vieja property, and from this axis the rock dips in all directions, beginning near the axis with an angle of about 5°, increasing to 30° and even to 45° on the outer slopes. This brings the limestone below the breccia at the valley-bottom in Santa Eulalia village; on the lower slopes of the mountain no limestone has been seen.

The mountain is deeply channeled by erosion and the ravines show many vertical escarpments, which are evidently due to extensive faulting of the limestone, the fault-planes then being worn down by the



Showing Position of Santa Eulalia.

drainage. While some writers have commented on the absence of faulting here, the evidence of a 700-ft. displacement in a faulted block near the Zubiate property seems conclusive, and one observer states that he has seen proof of a displacement of 1100 ft. This matter is of importance in its bearing on the interruption and displacement that would occur in the ore-bearing zones and orebodies in the faulting was subsequent to the mineralization. I have not yet observed any evidence on this point.

The upper part of the limestone exposed in the Democracia shaft is a coarse conglomerate, with calcareous cement, but, in freshly blasted surfaces close scrutiny is necessary to detect the real character of this rock. Following down the ravine that leads past the Inglaterra property to the village of Santa Eulalia, in the low ground, the conglomerate is well exposed, the boulders, which vary from 3 in. to 3 ft. diam., weathering conspicuously. This conglomerate is composed of water-worn material, and is a true sub-aqueous sediment, although volcanic action was taking place during the deposition of its upper portion.

The base of the conglomerate passes gradually

into the bedded limestone from which its boulders were derived, with the re-crystallized dust that cemented them. On the ridge above the Inglaterra and Democracia properties and elsewhere, the upper part of the limestone conglomerate has for its cement a paste of volcanic rock-dust. This conglomerate was not seen on the high ground near the Santo Domingo mine, and further study may show that it is limited in extent, and was formed as a beach-deposit on the flank of the Santa Eulalia uplift when this lay as an island in the surrounding waters. Above the conglomerate and, where it is lacking, resting on the bedded limestone, are extensive deposits of tuff and volcanic breccia, about 300 ft. thick, called by the Mexicans *cantera*, and by some Americans 'porphyry capping'. Intercalated with the breccia at some points, or cutting it horizontally, are thin sheets of lava. The breccia and conglomerate form a deposit that is seen at many points in northern Mexico resting unconformably on Cretaceous strata. The few hundred feet exposed at Santa Eulalia are probably only a fraction of the original thickness, which at Sierra Mojada is estimated at 1800 ft. Some of the Sonora conglomerates have been described by E. T. Dumble under the name of Baucari, Nogales, and Trincheras beds. The Baucari beds were observed in the district of Alamos, and the Nogales and Trincheras beds in northern Arizpe, near the Arizona boundary, but strata comparable lithologically to the Nogales beds are widely developed along the Yaqui river from Buena Vista to Tonichi. I called attention to a quartz-porphyry conglomerate, passing into a red sandstone of wide extent, at Planchas de Plata in the northern part of the Magdalena district, Sonora, and extensive beds of conglomerate form the summits of some mountain peaks in the Copete mining region of the Ures district of Sonora. Other conglomerates have been observed on the mountains near the La Brisca placers at Magdalena. If these conglomerates were shown to be limited to small areas, they might be regarded as lake deposits, but insufficient geologic field-work has been done in Sonora to prove their areal limits, and the possibility of marine submergence of this area during deposition cannot be denied with certainty.

The limestone encloses the main orebodies, the breccia being, so far as known, entirely barren except for small stringers of ore in narrow fissures. It appears, therefore, that while the mineralization occurred subsequent to the volcanic action that resulted in the deposition of the breccia, the precipitation of the metals was essentially confined to the soluble limestone. The ore occurs almost wholly in caves and chambers, in close association with old water-channels, though it is evident that these caves and channels were formed by subterranean drainage from the surface, subsequent to the mineralization of the limestone along its fissures, and contemporaneously with the oxidation and alteration of the metallic sulphides with which the limestone was primarily impregnated, and by which it was in part replaced. The original ore deposits were replacements of the limestone, chiefly by galena carrying silver, the sulphide of lead having subsequently been oxidized and altered to the carbonate, or cerussite. In some mines pyrite is found, together with calamine and smithsonite as alteration products from sphalerite. Zinc ores are said to occur in the mine El Potosí at a depth of 1600 ft. The oxidation of the larger masses of ore extends as far as the lowest workings, but occasional nuclei and stringers of galena may still be seen. The native miners identify two principal classes of deposits at *mantas* and *abras*, the former being approximately horizontal sheets of ore replacing soluble layers of limestone, and the latter representing replacements along the walls of nearly vertical fissures. These phases obviously pass into one another.

Philip Argall notes that the great caves, watercourses, and ore deposits occur along certain main fissures that have a general northerly direction, and are usually situated at points where the main fissures are intersected by cross-fractures. As the development of the district is extended it will be of interest to observe how far this generalization proves correct for the whole area. The wide and deep fissure of the Zubiate property, in which are said to have been large orebodies, has a strike at the surface of about N.70°E. magnetic. Mr. Argall also makes an observation that is of importance if generally true, namely, that in the process of oxidation the lead and silver were leached from the upper deposits to the lower, so that the ore in caves at higher levels is lean and limited in volume, while in the deep mines the caves are full of rich ore. This may be true of a number of properties, but tradition tells us that when the region was first exploited rich ore was followed from the soil downward.

Numerous dikes and sills of eruptive rock occur in the district, some of which were noticed near the Zubiate property, but whether all are of one variety has not been determined. In the southeastern part of the district they are abundant, and in the San Antonio property, orebodies are found at the contact of the limestone with a porphyry intrusion. These contact deposits are said to continue across the Enriqueta into the Carlota. The workings in the El Potosí mine have attained a depth of nearly 1800 ft., and it is said that in this part of the district most of the large orebodies opened within the past few years are below 1000 ft. When and where the downward limit of secondary enrichment will be found is a question of great interest.

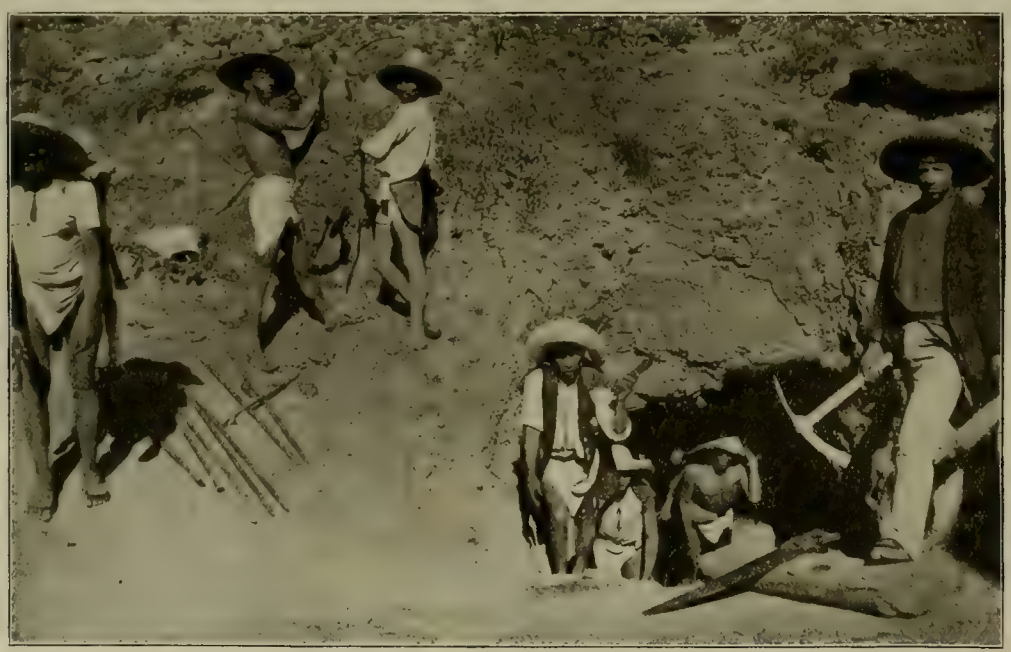
In the early days of the district, many bonanzas were found containing chloride and sulphide of silver, and some are found still, but the output now is of moderate grade, probably not exceeding an average of 20 oz. silver for the better class of ores, and there is a considerable tonnage assaying as low as 6 oz. per ton. The lead content is said to average below 25%, with considerable amounts of iron and alumina. These ores, though relatively low in grade, are of special value to the smelters for their fluxing qualities. As far back as 1867 Lew Wallace wrote that the Santo Domingo and Dolores ores were chiefly valued as fluxes.

The discovery of ore at Santa Eulalia is often a

matter of chance. In the beginning ore was followed from outcrops in the limestone, and from the caves entered in the progress of this work 'leaders' were traced laterally into other chambers, the position of which was a matter of speculation. But the general richness and extent of the mineralization amply justified the search. The so-called 'leaders' are narrow fissures in the limestone filled with ferruginous argillaceous matter, which contain traces of lead, but rarely any important amount of silver. In following these fissures, small cavities and water-channels are frequently cut; these, in themselves, are of no value but suggest the existence of larger channels and caves in the neighborhood.

As the district attracted attention, and the ground on which limestone was exposed at the surface was located by 'denouncement', it was necessary in seeking new deposits to sink through the 'porphyry capping' or beds of breccia. Shafts thus sunk were continued until ore was found or promising leaders were discovered, the latter being followed by drifts, winzes, or raises until an orebody was opened. The practice in this respect at Santa Eulalia is similar to that at Sierra Mojada, where sometimes a leader has been followed 300 metres in the search for ore before success rewarded the miner's effort. It is obvious that in a limestone, irregularly impregnated, a shaft may easily miss an orebody. Lateral exploration must then be resorted to. It is obvious that in ground like that of Santa Eulalia exploration should be backed by ample capital, and continued with rigid economy, as no one can estimate beforehand the cost of finding ore. This is exemplified in the Baltimore property, where a shaft was sunk 1300 ft. without finding ore, although numerous leaders were intersected. Similar conditions doubtless exist in many prospect shafts, concerning which the facts have not been made public. In faulted ground, moreover, the displacement of ore-bearing horizons may lead to unexpected expense in finding ore.

The present condition of Santa Eulalia is eminently one of prosperity. In spite of some failures, there are many successes. Whether the ore be high-grade and valuable for its silver content, or low-grade and esteemed for fluxing, it appears to find a ready market. Transportation facilities are excellent. The Chihuahua Mining Co. operates a railway from the outskirts of Chihuahua into the northern and central portions of the district, handling the output of the Santo Domingo, El Potosí, and other mines. The San Toy Mining Co., operating the Galdeano and other properties, transports its ore by a wire-rope tramway to a branch of the Ferrocarril Mineral. The newer mines of the eastern part of the district have no railroad connection, but busy strings of burros carrying sacks of ore to the station at Santa Eulalia give proof of productivity. The transportation rates to El Paso are favorable for the shipment of low-grade ore, though some of this goes to the smelter at Torreon. Only a few miles from the camp, on the plain toward Chihuahua, is the new Guggenheim smelter. Labor commands about the same price as at other large camps in Chihuahua, though contractors have learned to make better profits. For sinking shafts less than 500 ft. deep ₱50 per metre is a regular price. For depths greater than 500 ft. ₱70 per metre is usual. To this should be added about ₱30 per metre for expenses of hoisting, blacksmith work, and incidentals. Mine-timber costs about ₱60 per M. board measure, delivered on the ground. A point of advantage at Santa Eulalia is that the mines are generally dry, so that little expense is incurred for handling water.



Mexican Miners at Work.

MINING ON THE MOTHER LODE.

Written for the MINING AND SCIENTIFIC PRESS
By H. W. TURNER.

The Mother Lode in California is understood to mean a belt of quartz veins in the Sierra foot-hills extending from the American river on the north border of Eldorado county, southeasterly across Eldorado, Amador, Calaveras, and Tuolumne counties, and terminating near the town of Mariposa in Mariposa county, where the black slate, in which the greatest number of veins lie, is cut off by intrusive granite.

To the north of Eldorado county, the black slate continues nearly to the town of Colfax, but this formation does not contain any notable mines north of the American river. The rich mines of Grass Valley are in the line of strike of the lode, but the veins of that district are separated from the great lode by a barren interval and belong to a different system, although probably of the same age.

The Mother Lode represents a belt of shearing and faulting in relatively weak rocks (slate and schist), resulting in the formation of many nearly parallel fissures in a narrow zone. The veins or fissure-fillings are therefore not continuous.

The lode is found within a belt of clay-slate (the Mariposa formation), but it is not confined to this formation. Thus the main veins at Angels are in greenstone-schist to the east of the black slate belt, and in central Mariposa county, the largest veins, although poor in gold, are in serpentine or at the contact of serpentine or greenstone with slate. South of the town of Mariposa there is a tongue of schist extending southeasterly into Madera county and in this tongue there is a series of veins, some of which are productive, such as the Grub Gulch and Coarse Gold. This series is by some regarded as an extension of the Mother Lode.

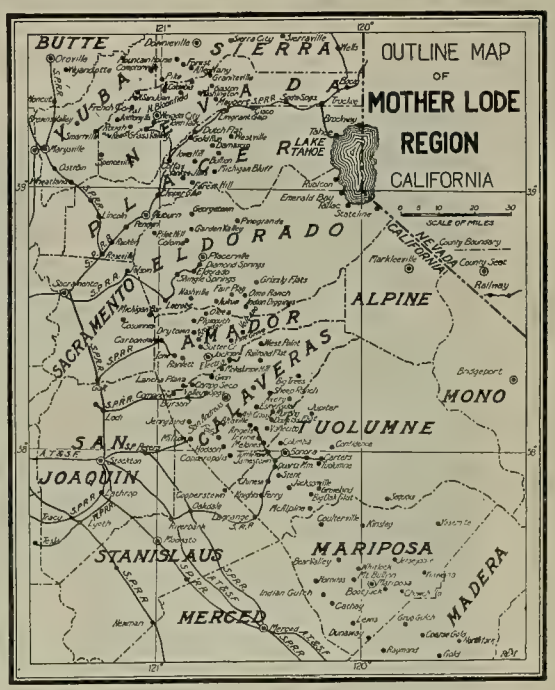
The ores of the lode are all relatively free milling. The gangue in the clay-slate is chiefly quartz with very little calcite. Pyrite is always present and other sulphides occur in small amount, such as chalcopyrite, blende, and galena, the last two being usually indicative of gold.

In the amphibolite-schist, the gangue is chiefly quartz, but there is often considerable calcite. Pyrite is abundant and chalcopyrite, blende, and galena are present. In a number of veins tellurides of gold and silver occur; the tellurides of lead and of mercury are rarer.

In the veins within serpentine or near serpentine contacts, the vein-material is quartz, dolomite, and mariposite. The ordinary sulphide is pyrite, but others occur. Arsenopyrite is present in the Rawhide mine, and in the Josephine in Mariposa county ilmenite or titanic iron ore.

The ordinary reduction process on the Mother Lode is crushing by stamps, amalgamating on silvered copper plates, concentrating on vanners and tables; in addition, canvas plants are used for further saving of the fine concentrate from the slime. The quantity of quicksilver consumed in the amalgamation process is about 0.15 oz. per ton of ore. The bullion contains about 5½ oz. gold to 1 oz. silver. The concentrate is shipped to the smelter, or, as at the Eagle-Shawmut and Lightner, is treated in a local chlorination plant. Formerly the pyritic concentrate from the Amador county mines was treated mainly in the chlorination works at Drytown and Sutter Creek, but it is now cheaper to ship this product of the mill to the smelter; in consequence, the Amador county chlorination plants are now idle.

In Calaveras county the main activity is on that portion of the lode extending from Angels south to Robinson Ferry. In this area 350 stamps are now dropping and a 20-stamp mill is being erected for the Etna-King. The famous Morgan mine, together with the adjoining Union and Kentucky claims, is being opened up by the trustee for the Fair estate,



the litigation that has been pending for many years having been settled. The Morgan claim produced the largest single chunk of gold ever found in a California quartz mine and is credited with a total production of $3,600,000 within 400 ft. of the surface. The veins in this part of the lode are remarkably strong, standing out as huge white reefs along the crest of the ridges. In most cases the rich ore is found adjoining one of the walls of these large veins, which are often from 50 to 75 ft. thick, the main mass of the quartz being poor in gold. At the mines at Angels much of the ore consists of mineralized schist with numerous quartz stringers. The Melones mine is being worked by the caving system in a great open-cut on top of Carson hill on the Reserve claim, the ore being dropped down a rock chute about 1000 ft. in depth to the adit, where it is run out to the 100-stamp mill at Robinson Ferry.

The main producing counties of the Mother Lode are Amador, Calaveras, and Tuolumne, the first being the most important. In 1905 in these counties 1,601,296 tons of ore were milled, chiefly from the Mother Lode mines, the average recovery per ton of

ore being $3.62. The average total cost of mining and milling, including management and depreciation, varies from $2 to $3 per ton, and it is claimed that the total cost in the Melones mine is below $2 per ton. Nearly all the mines are worked through shafts, a prominent exception being the Melones, the main adit of which starts near the Stanislaus river and extends north to a point under the crest of Carson hill. Electric power generated by water and direct water-power are mostly in use, but both wood and oil are also employed to generate steam. The ore is usually soft, allowing a high duty, often 4 tons per stamp per 24 hours. The soft slate walls and wide veins cause the bills for timber to run high, frequently 35c. to 40c. per ton of ore extracted. Square timbers are used and also the local digger pine. In general, all mining supplies are cheap and labor is low, $2.50 to $3 per shift.

During 1908 work has been going on at the Bunker Hill, Bay State, Keystone, Fremont, Oneida, South Eureka, Central Eureka, Argonaut, Kennedy, Zeile, and Amador Queen in Amador county; at the Gwin,



Kennedy Mine, California.

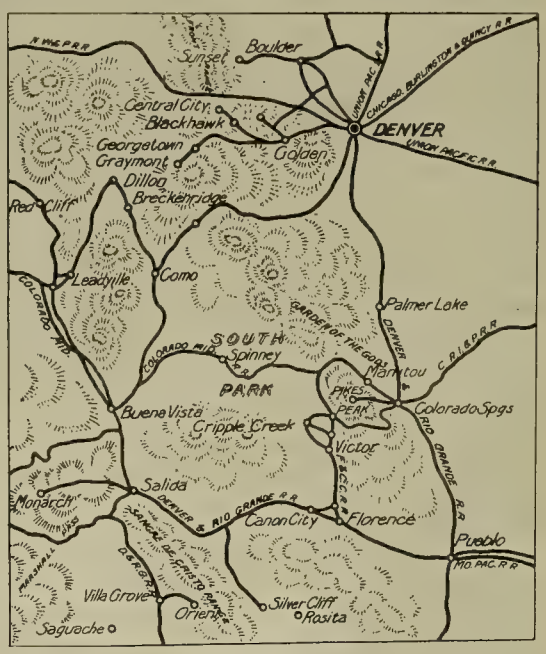
Lightner, Etna-King, Utica, Gold Cliff, Angels, Bruner, Chaparral Hill, Finnegan, and Melones mines in Calaveras county; in the Tarantula, Harvard, App, Jumper, and Eagle-Shawmut mines in Tuolumne county; and at the Josephine, Princeton, and Mariposa mines in Mariposa county. There has also been activity at the Mack mine at Big Oak Flat, but this is not strictly on the Mother Lode.

Exploration to the depth of over 1400 ft. in the large mines on the Mariposa grant seems to indicate that while the veins remain strong, the gold decreases with depth; but with the Gwin, Kennedy, and many other mines the ore has not become impoverished with depth, although, of course, the costs have increased. The Gwin has good ore on the 2400-ft. level and even deeper, and the Kennedy is said to have good ore 3000 ft. vertically below the surface. The Eagle-Shawmut is down 2600 ft. and better ore is reported on the lower levels than above, although heavy in sulphides. In the chlorination plant at this mine there are two roasting furnaces—a 20-ton Hall, and a 10-ton Edwards. Oil fuel is used. The mill is run by water-power, and has 100 stamps of 1000 lb. each, and 40 Frue vanners. During the year over 1000 stamps have been dropping on the Mother Lode, but many mills were closed down from lack of water in the late summer and early fall months.

CRIPPLE CREEK IN 1908.

Written for the MINING AND SCIENTIFIC PRESS
By W. W. TRAVELL.

It must be admitted that the Portland mine now stands as the Independence did some four years ago, when the consulting engineers to that company advised the London office to introduce the leasing system—that is, the Portland is very much of a shell. Its main orebodies, like those of the Independence, are worked out, the average grade of the ore cannot be much more than $16 per ton, and, although the Portland company has its own mill at Colorado City, the profits must necessarily be small, owing to the great amount of waste, large expense of timbering, long tramming distances, and the very low grade of the ore. One must not, however, lose sight of the fact that in this mine the line of contact with the



A Part of Colorado.

granite, pitching as it does from the Independence north end into the Portland, will give pay-ore at a much greater depth than in the Independence. On the latter property Mr. Hammond carried the shaft down to the 1400-ft. level, and did much driving and cross-cutting at that depth, without finding any ore better than $3 or $4 per ton. The pay-ore below 1100 ft. seems to have been cut off at the contact. The Portland may continue to do fairly well a little deeper than this, although, as before stated, the ore seems, on Battle Mtn., to become poorer in depth. The company undoubtedly has a valuable asset in the dumps; these cannot be less than 1,500,000 tons, and remembering the fact that the Portland company, for years, never leased or washed the dumps, the average value of the whole should not be less than $4 per ton. This is a considerable item. It is known that the company has been experimenting on the dump ore for some time at Colorado City, and is now erecting a small plant (10-stamp mill) near the mine.

They are proceeding carefully, spending probably not more than $15,000 on the outfit. The method will be to convey the ore automatically to the mill for crushing, pass it over concentrating tables, and then cyanide. The tailing will be put over a second table. It is reported that they are going to very little expense in the matter and are obtaining the most up-to-date tables; by reason of many years of experience in milling their oxidized ores at Colorado City they should be able to devise the best and cheapest means for treating the dumps. It would seem wise, judging by the experience of the Stratton's Independence company, to lease the upper levels of the property, instructing their superintendent to watch the timbering and attend to the general supervision of the lessees. Twenty or thirty sets of brains are better than one in following and discovering ore, and should the Portland company decide to lease the upper workings, I believe their experience would be even more gratifying than that of the Independence, which, after losing some $50,000 in one year on company account, made a profit next year of $1,000,000 —the mine making $500,000 and the lessees, $500,000.

Four years ago the Stratton's Independence mine reached the condition in which I have described the Portland to be, and the consulting engineer wisely decided that the time for leasing had come. His good judgment was only too well proved by the splendid results, both to the lessees and company, since then. Certainly not less than a million dollars had been made by the company, and a similar amount by the lessees during that time. There was much unfair criticism by the press and public regarding supposed exorbitant charges for royalty, hoisting, air, etc., but time proved that such was not the case; the lessees made an almost equal profit with the company. It is common knowledge that a lessee can and does work 30% cheaper than a company, to say nothing of having some 30 or 40 alert miners looking for ore. So that when a large mine like the Portland or Independence finds its main orebodies exhausted, with nothing but small stringers, an occasional pocket to find, and mainly development work to do, it is well to lease the workings. The Independence is now in its secondary stage, that is, where the lessees have practically cleaned out all the pay-ore, although there are still some fourteen sets of lessees making a little money for themselves, and a little for the company. It has been deemed wise to make a further change. There are many thousands of tons of ore running from $5 to $10 per ton in the mine, and undoubtedly much of better value would be exposed if a system of caving were adopted, for whenever caves have occurred in the mine good ore has been opened up. Experiments having shown that refractory ores of low grades can be mined and milled at a profit, the management decided to build a mill for this purpose. Moreover, after being most thoroughly sampled by George A. Schroter, who put down some 25 shafts all over it, taking waste and ore just as it came from the shafts and crushing and sampling it, and reducing all assays to $6 per ton, the dump showed an average value of $3.75 per ton. Some 700,000 tons of ore averaging not less than $4 per ton must be on these dumps, and Philip Argall, who has spent some $300,000 on an elaborate mill, will now have an opportunity to show what can be done toward the successful treatment of this immense tonnage. From the data given by Mr. Argall, his cost of extraction should not exceed $2.75 per ton, so that if Mr. Schroter's figures are correct (and we have every reason to believe that they are) this would leave a net profit on the dump alone of about $700,000. As we understand that the company in London has, under a re-organization scheme, raised the necessary funds to pay off all machinery and other debts, leaving a handsome sum on hand to enable Mr. Argall to push his tests to completion, we may reasonably hope to hear of definite results within the next two months. Should the mill prove to be a success it will mean much for Cripple Creek, as there are immense tonnages of low-grade ore in most of the larger mines, and many of the smaller ones, and it will give a stimulus to the camp for many years, besides increasing the possibilities of opening up higher-grade ore while working on the poor stuff.

The Golden Cycle mine has been one of the steadiest and largest producers in the camp for many years, and the great help given to the Cripple Creek district by J. T. Milliken in building an 800-ton mill at Colorado City and treating (in addition to the Golden Cycle ore) custom ore, cannot be over-estimated. Their rate of $4.50 for freight and treatment on $8 ore was the means of making the camp look like 'old times' again, for almost every property with anything in sight, commenced operations either under lease or company account, and everyone was looking for leases in the mines or on the dumps. The United States Reduction & Refining Co., to meet this competition, put down their rates even lower than the Golden Cycle, making a $3.50 rate on $8 ore (though they have since raised this twice during the last three months), thus more than ever stimulating development work all over the district. Unfortunately many lessees shipped thousands of tons of dump ore that ran close to $4, leaving the Reduction company but little margin for loss, hence their reasons for putting up their rates to discourage the shipment of ore running under $10 per ton. However, the good work done by the Cycle people is highly commendable, and has been the means of bringing the camp back to a good monthly tonnage. The Cycle property is now working at a depth close to 1400 ft. and yields about 150 tons per day of ore averaging close to an ounce. This mine differs from the Portland and Independence in that much of its better grade of ore is found in the lower levels, having immense bodies of its highest-grade ore at 1200, 1300, and 1400 ft. I consider the Cycle good for a tonnage of 150 per day of ounce ore for many years, with great possibilities in their lower levels. The ownership of reduction works is a feature that will enable this company to continue production when their ore becomes much lower in grade.

The Elkton mine is producing about 2000 tons per month of good-grade ore, probably an average of $25 per ton. I consider the Elkton one of the best properties in the Cripple Creek district, with possibili-

ties of a long life. Large bodies of ore of grade better than an ounce exist at the lower levels. At 900 ft. (just about water-level) an excellent showing is being developed, and with the completion of the drainage adit large bodies of high-grade ore will be exposed that have been covered during the last few years since pumping operations on the lower levels ceased. A large tonnage of good-grade ore will undoubtedly be shipped from this property for many years. The Cresson mine is also steadily yielding ore averaging close to an ounce. At present some development work is being done, so that the tonnage is not as large as usual, being in the neighborhood of 1500 tons per month. The Dante, Trilby, Blue Bird, Gold Sovereign, and their neighbors have excellent showings and are making a fair output. The Dante is the best of these, producing about a car per day of ore averaging $20 per ton. The Isabella is not doing quite as much as usual, but the cyanide mill seems to be successful with the dump ore, and as this property from the 100 to 700 ft. is in the oxidized zone, there should be no trouble in treating many thousands of tons of ore too low to send to the reduction works.

Work is progressing satisfactorily on the drainage adit, some 4000 ft. having been driven, and an average of about 12 ft. per day is being maintained. With the completion of the adit, the El Paso, Elkton, Portland, Strong, and many other properties will undoubtedly be greatly benefited, so that, taken as a whole, the camp should be a producer for many years yet of, say, some 40,000 or 50,000 tons per month of ore of an average grade of $15 to $20 per ton.

The Vindicator mine has been one of the large producers of the camp and, at present, is worked almost entirely by lessees. Some of the richest ore found in Cripple Creek has been taken from this property, and many of the lessees have done exceptionally well. I consider it will be a steady shipper for many years yet, with possibilities of opening up additional orebodies under the leasing system. The main ore-shoots have been worked out, but much good territory remains undeveloped. A steel shaft-house and head-frame 80 ft. high are being constructed at the No. 1 shaft, showing the company's confidence in the continued finding of ore. At present they are making an average production of about 1600 tons per month, and four dividends, amounting to $45,000 each, have been paid since the first of the year.

About the beginning of 1908 the El Paso Gold Mining Co. decided to lease its upper workings, which showed little or no profit under company management, pending the completion of the new drainage adit. Their good judgment has been proved by the majority of the lessees doing well and paying the company fair royalties. This one mine should become one of the most active producers when the drainage adit is completed, as undoubtedly large bodies of good-grade ore exist in the lower workings.

The Strong mine is one of the steady producers of the district, the ore being almost entirely in the granite, near the contact. There is good ore at depth, and I anticipate production for many years. Several million dollars have been paid to the owners during the past ten years; it is a close corporation, having only three or four owners. Their present output should not be less than 2500 tons per month of $30 ore. During the period that the Gold Coin mine, now called the Granite, was owned by the Woods family it produced many million dollars worth of ore. It is, however, practically worked out and, although a few sets of lessees are working, their output is small, and I do not anticipate much from this property, until perhaps such time as the mills can treat the very low-grade ores at a profit. Although during the past twelve months the output from the Findlay has not been large, I understand that reserves are stored in the stopes and in the lower levels (1200 ft.) good ore is said to exist. Under vigorous management and development work the Findlay should be a steady producer for many years. The Hull City Placer main workings are merely a shell, but with territory well located and not yet tested. This mine is under lease entirely and will probably produce a fair tonnage for several years.

The Mary McKinney, one of the old mines, is now under lease to the Western Investment Co., which has sub-leased to several sets of lessees. A fair tonnage of moderate grade is being shipped and with the development work now under way, this property should continue to maintain a steady output. The Doctor Jack Pot, Work, and adjoining properties are producing, chiefly under lease, with prospects of continuation.

The entire Stratton Estate properties, such as the American Eagles, Lucky Gus, Specimen, Sacramento, are under lease and many of them are productive. Several new orebodies have been discovered on the American Eagles. The Lucky Gus, under lease to H. G. Moore and associates, has been one of the best operations in the camp, having paid each of the three lessees some $50,000 during the year, and they are still making a good production of high-grade ore. Generally speaking, with the necessary development, the properties of this estate should produce a fair tonnage during the next five years.

The platinum output of Colombia is second only to that of Russia. This precious metal, washed from the gravels of the Chocó, is found associated with gold, the platinum, however, predominating. Although platinum occurs to some extent in other parts of the Chocó, the main sources are the Platina and Condota rivers, and a few tributaries, as well as the streams running into the Cajon, all being affluents of the San Juan river. The metal is also obtained from the Agua Clara river and portions of the Bebera river, both of which flow into the river Atrato; it is obtained also from the Cartegui, the main affluent of the Quito river. Though platinum occurs in the wide areas of the Chocó in the stream beds, and on the banks bordering the San Juan valley, it has not yet been found in veins. It seems to be a re-concentration from older gravels, deposited apparently in the Tertiary age.

COAL MINING IN CHINA.

Written for the MINING AND SCIENTIFIC PRESS
By THOMAS T. READ.

Mining interest in China is at present chiefly centred in coal. Indeed, this is likely to remain permanently the case, for in the list of the mineral resources of China coal easily takes first place. The present output of coal, something like 15,000,000 tons per year, probably exceeds in value all the metallic products combined.

The principal coalfields of China fall into three large groups. First and most important is the North China field, an aggregation of smaller areas. In various places in the provinces of Shantung, Chili, and Shansi, and also in Manchuria, valuable coal seams outcrop and are more or less actively worked. The larger part of the total production at present comes from these fields. Their detailed description will be given later on. The second, or southern field, centres about the southern part of the province of Hunan. One large mine is here worked by foreign methods, and there is also a large production from native mines. The third, or western field, is in the basin of the Ssu-chuan. I have not visited this field, and can only cite Von Richthofen,[1] who says, in substance, that coal is very generally worked throughout the province, the Mesozoic strata being extensively folded and cut across by rivers, thus conveniently exposing the seams for the native method of working. The coal is not of so good quality as that of the southern field, so it is not shipped down the Yang-tze to compete with other coals in the markets of the lower river. The difficulties of navigation on the upper Yang-tze undoubtedly have much to do with this, as well as its quality. In the northern and western part of the province the quality is better. A foreign company has secured a concession at Wanhsien and has installed foreign machinery, but I do not know how much they are producing at present.

In the southern field the chief producer is the P'ing-hsiang colliery, owned and operated by the Han-Yang Iron Works. This mine is in the province of Kiang-si, just on the borders of Hunan, and on the northeastern border of the field. At present it has a production of something over a half million tons per year, but this is steadily being increased, the limiting factor being the transportation on the Hsiang river, which is very shallow during a large part of the year. About three-quarters of the coal is made into coke at the mine, where there are six modern retort batteries, or 154 retorts in all. The remainder is shipped as lump coal to Hankow for the use of the iron works and for sale in the open market. There are two washing plants for washing the coal before coking. Electric haulage is employed underground, this being the only mine in China employing electric haulage. There are many native mines worked in the vicinity. Coke is also made in native ovens. A missionary writer speaking of coal in China has gravely said that the Chinese make their coal into coke because the coke is lighter and hence easier to transport. The real explanation is that the coals are generally so friable that they will not bear transportation. From this point the coalfields extend south and west over a large area, and are worked in many places by the natives. Von Richthofen says that the coal becomes anthracite toward the south and is of much better quality, but because of the transportation difficulties development has lagged. When the Canton-Hankow railroad is finally in operation this portion of the field should also become important. It is impossible to estimate the amount now produced in this district.

There are numerous companies under foreign supervision in the northern field. Of these the oldest, largest, and best known is the Chinese Engineering & Mining Co., which operates at Tongshan and Linsi, in northeastern Chili. The total production is fairly constant at about a million tons per year. The mines are well equipped with modern machinery; a 3000-kw. electric plant for hoisting underground, pumping, and for lighting having just been installed at the Tongshan mines, and a similar plant at Linsi. Another mine is about to be opened with Chinese capital, about half-way between these two mines. The work at this mine was fully described by Hoover[2] a few years ago.

In Shantung there are several fields. The Schantung Bergbau Gesellschaft is operating mines at two places, Po-shan and Fank-tze, and produces about 200,000 tons per year; native workings in the vicinity produce an indeterminate amount. The coal from the German mines is washed before being sold. The fields are not large, and the coal is not of the best quality.

Farther to the southeast, near Yi-hsien, there is a larger and better field. Coal is worked here in native mines, and a short line of railroad is now being built to connect the producing district with the Grand canal, and will doubtless also connect with the Tientsin-Pukow railroad when the latter is finished. The short line should be in operation within a year, and the Tientsin-Pukow line is now under construction. Modern methods will be introduced with the advent of the railroad, and this district should shortly become an important producer. The mines here are entirely in the hands of the Chinese, and I have not heard whether they are to be under foreign supervision.

The largest, most important, and least developed field in north China is the great anthracite field of Shansi, which has an extent of nearly 200 miles north and south and 25 to 30 miles east and west. Various writers have described this field as a whole, or in part, and these accounts have recently been summarized by Willis.[3] The best account is that of Drake,[4] who estimates the average thickness of the workable beds as 22 ft. Richthofen has estimated its area as 13,500 square miles, which corresponds to a total quantity of 350 billion tons in the whole field (Willis). The quality of the coal is excellent, as shown by the analyses, but, as is not uncommon with Chi-

[1] "Die Kohlenfelder Chinas', p. 177.

[2] Hoover, *Eng. and Min. Jour.*, August, 1902.

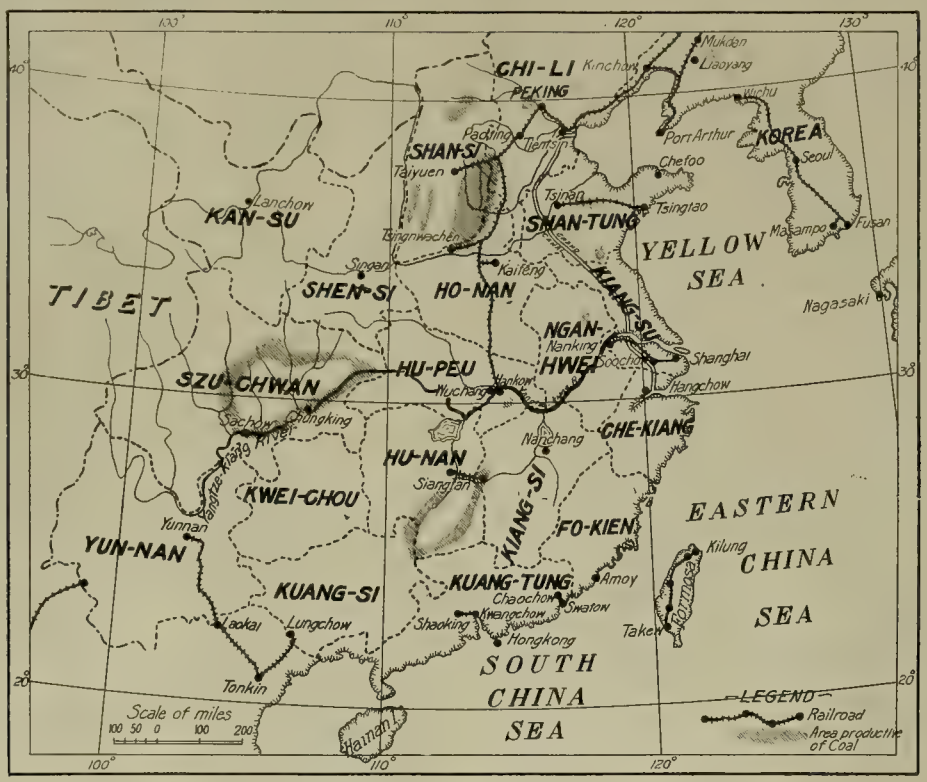
[3] "*Economic Geology*, Vol. III, No. 1 (1908).

[4] *Trans.* A. I. M. E., Vol. XXXI, p. 492 (1901).

nese coals, the ash is rather high. In contrast to the coals from many other localities, it yields a very large percentage of lump coal. The lack of transportation facilities has been the restraining factor in preventing the development of the field. As yet it is only touched at three points by branch lines from the Peking-Hankow railroad. At the southeast edge of the field, in northwestern Honan, the Peking Syndicate has two shafts, but the work of exploitation does not seem to have been directed with a high degree of engineering skill, and the mines are only just beginning to make a small production after some years' work. The all-rail freight rates are so high that the company continued its branch line across to the banks of the Wei river, and from that point the coal goes in native boats down the river to the Grand canal, and thence to the ports.

of coal is produced by the natives, and there is one mine under foreign supervision at Ching-hsing (Ching-Ching). The working capital of this company has recently been increased and a German director appointed to act with the Chinese director, so the production will probably soon be largely increased. The high freight rates on these coals from the Shansi field makes them so expensive by the time they reach the ports that they are not used as much as their superior qualities might lead one to expect. The Imperial Railways are making such enormous profits that they could easily afford to stimulate the mining industry by lowering the freight rate, but apparently such a piece of foresight has not occurred to them.

Twenty miles or more west of Peking there is also a large production of anthracite coal from native mines, but none of these is using modern methods.



Map of China, Showing Coal Areas.

Somewhat farther north, in Chili province, are mines at Lincheng, from which the coal supply for the Peking-Hankow line is derived. These mines are only 10 to 12 miles distant from the main line, with which they are connected by a short branch. The mines are said to be worked under foreign supervision, and the production must be of considerable importance, as they supply the general market as well as the 750 miles of railroad, but I have not been able to obtain accurate details regarding them.

Still farther north, the northern edge of the field is tapped by a 160-mile branch line to Tai-yuan-fu, the capital of Shansi. This is a narrow-gauge road, and does not seem to be regarded with admiration by the foreigners who have been over it, who question its ability to handle any great amount of traffic. In the district tributary to this line a large amount

Drake[4] has described this field in detail. Still farther north, near Kalgan, at Hwai-lai, the Peking-Kalgan railroad proposes to open a mine to supply its line with coal; this will probably be in operation within a year. West of the Shansi anthracite field is a bituminous field that Richthofen thought to be as large as the former, but the transportation difficulties practically remove this field from commercial consideration for the present. Farther west and north, coal is known to occur in various places.

attention, but the only available details regarding them are to be found in the reports of the Japan Geological Survey. The principal fields are at Saima-chi, Pen-su-hu, Wu-hu-tsui, and Yen-tai; the last

The coal mines of Manchuria have attracted much

[4] *Trans.* A. I. M. E., Vol. XXXI, p. 492 (1901).

being the best known and most actively worked. The coal is anthracite, or semi-anthracite, rather high in ash, and very friable, so that only a small percentage of lump coal is obtained. All these mines are now completely under Japanese influence, and will be developed in the interest of the Japanese.

TABLE OF ANALYSES.

	Analysis No.				
	1.	2.	3.	4.	5.
	%	%	%	%	%
Moisture	0.77	0.77	2.91	1.93	?
Volatile Hydrocarbon.	27.40	28.05	tot. c.	3.45	22.35
Fixed Carbon	53.28	51.97	86.80	81.44	68.90
Ash	18.59	19.18	9.88	14.17	8.70
Sulphur	1.11	0.88	0.41	0.35	0.10

1. Tongshan Mines C. E. & M. Co. Average analysis, furnished by company.

2. Linsi Mines C. E. & M. Co. Average analysis, furnished by company.

3. Southern part of Shansi field. Average of 6 analyses by Shockley. *Trans.* A. I. M. E., Vol. XXXIV, p. 840 (1904).

4. Northern part of Shansi field. Average of 6 analyses by Drake. *Trans.* A. I. M. E., Vol. XXXI, p. 492 (1901).

5. P'ing-hsiang bituminous. Average analyses, furnished by company.

The foregoing table of analyses, gathered from various sources, illustrates the range of composition of the coal from the bituminous and anthracite areas of the northern field and the bituminous part of the southern field. Analyses 1, 2, and 5 are averages of a large number of daily determinations, and represent the average product with corresponding accuracy. Analysis 5 is of washed coal after drying. The coal as mined contains about 28% of ash. Analyses 3 and 4 are each averages of six analyses from different places in the same field, and may be taken as fairly representative. As may be seen from these, the coals are of excellent quality, except that the ash is at times undesirably high; the coal is generally of coking quality in the bituminous fields.

The accompanying map shows the general distribution of the coalfields. The map is taken from Richards' 'Geography of China', and in the areas assigned to the fields the map by Willis has been generally followed, although some necessary corrections have been made. The boundaries of all the fields are rather indefinite, as none of them have been studied in sufficient detail to fix their exact limits. In addition to the areas shown on the map, coal is known to occur in many other areas, Yun-nan, for example, but no attempt has been made to represent these, as the information regarding them is too indefinite. While the importance of individual fields has at times been overestimated by too sanguine observers, the estimates of the total coal resources of the Chinese Empire are generally below the amount available. It may be said that the coalfields of China have a large extent, the coal is generally of good quality, and the fields are widely scattered, so that it does not require to be transported any great distance from the points of production to reach every part of the empire. Nearly every coalfield is seriously handicapped by inadequate transportation facilities, but numerous railroads now building in different parts of the empire will soon provide markets and open the way to proper exploitation.

TAXATION OF MINING PROPERTY.

Written for the MINING AND SCIENTIFIC PRESS
By H. W. TURNER.

In the United States and its possessions generally, mining property is taxed in much the same way as other property; that is, the taxes are largely levied on the improvements.

In British Columbia, in the State of Nevada, and in Mexico, on the other hand, the chief taxes are levied on the product. This method is a distinct advantage to the mining industry, without decreasing the revenue from taxation. Mines that are producing can well afford to pay a reasonable tax, while those in the prospecting stage, or those that are temporarily shut down on account of low price of the product, or for other reasons, are not taxed, and hence debts are not piling up against them.

In British Columbia the method of taxing mining property is as follows: "Mineral or placer claims when Crown-granted are subject to a year of tax at 25c. per acre, but if $200 is spent in work in a year this tax is not levied. A tax of 2% is levied quarterly on all ores and other mineral substances mined in the Province, based upon the net value of such ore at the mouth of the shaft or tunnel, but where ore-producing mines yield less than $5000 in a year, half the tax is refunded, while placer or dredging mines that do not produce a gross value of $2000 in a year are entitled to a refund of the whole tax. These taxes are in substitution for all taxes on the land, and for the personal property tax in respect of sums so produced, so long as the land is only used for mining purposes. By the 'Land Act' a royalty of 50c. per M, board measure, is levied on timber suitable for mining props, a cord of props being considered as 1000 ft. board measure."

In the State of Nevada, the mine tax law is as follows: "All the proceeds of mines, including ores, tailings, borax, soda, and mineral-bearing material, of whatever character, shall be assessed for purposes of taxation, for State and county purposes, quarterly, in the manner following: From the gross yield or value of all ores, tailing, borax, soda, or mineral-bearing material, or whatever character, there shall be deducted the actual cost of extracting said ores or mineral from the mine; the actual cost of saving said tailings, the actual cost of transportation to the place of reduction or sale, and the actual cost of reduction or sale and the remainder shall be assessed and taxed at the same rate, *ad valorem*, as other property is taxed."

There is no reason why a law based upon this principle should not be put into effect in California and other States. The attempt to deduct costs, in order to reach a net value of the output, is open to many objections. It encourages favoritism and falsification. The original draft of the basal mining law of the United States, prepared by Senator Sherman in 1866, contemplated a tax of 3% on the market value of the product. The change would seem desirable. It can, however, only be effected by the organized effort of the mining community.

PROGRESS IN CYANIDATION.

Written for the MINING AND SCIENTIFIC PRESS
By ALFRED JAMES.

Introductory.—In reviewing progress in this important branch of metallurgy, I venture to remind my fellow-workers that only by mutual co-operation can efficiency be maintained. One man can only hope to achieve a certain amount (let us term it x) of work, but 100 keen technical men putting their experiences together ought, by each proceeding from the other man's achievement instead of repeating the preliminary failures and troubles and costs necessary to attaining that position, to be able to accomplish something more nearly approaching 100 x. Let us realize what it means to make the same mistake only once, and proceed one step farther and realize what it would mean if the same mistake were made only once by one man out of the 100; then we can appreciate how even details of difficulties and failures are of value—it may be as examples of what to avoid—as well as triumphant records of difficulties smoothed out, losses eliminated, costs lowered, and extractions raised.

My notes of last year were necessarily hurried and cursory. They were written at sea, far from my records. Since then I have had an opportunity of visiting two of the greatest and most advanced mining regions, Mexico and South Africa. Such personal contact with local problems is of immense service, for the greater and wider an individual's experience the more he finds to learn.

Slime Processes.—Once more progress seems to have centred mainly in the production and treatment of slime. All-sliming may certainly be a moot question for certain ores, when the sands may be treated cheaply by percolation and do not yield a greatly higher extraction by total-sliming, but nevertheless all-sliming certainly seems to have 'come to stay,' as anyone cannot fail to believe who sees already scrapped the huge nearly new Blaisdell equipments at El Oro and Dos Estrellas; scrapped not for any fault of the apparatus, but because all-sliming with cyanide solution through the mortar-boxes has taken away the very reason for the existence of these labor-saving appliances. Anyone who has studied J. C. Butler's (Guanajuato) curves showing the amount of gold coming into solution in the battery against that dissolved in the sand-vats must find considerable food for thought; indeed, one is tempted to wonder whether the natural result of such a curve is not to indicate the desirability of abandoning the sand-plant entirely, delivering the pulp, properly prepared, into the slime-vats. Even in the chief gold-field of Mexico (El Oro) copper plates are already disappearing, but in spite of their having been ripped out at the El Oro and Dos Estrellas mills, the gold extraction obtained does not appear to have suffered either in cost or percentage, but rather the reverse.

As a result of the general inclination to sliming, increased attention has been given to means of fine crushing. Tube-mills have more than held their ground. We no longer hear of "pans *v.* tube-mill" tests. Tube-mills are being installed almost everywhere with the exception of Australia and India. New types of mills have been advertised, but the old long cylindrical form still holds the field, with an established preference in big plants for a mill of from 4 ft. to 5 ft. 6 in. diam. by 19 to 22 ft. long. In the matter of certain tube-mill details, and of air-agitation, and of the wide-spread adoption of vacuum-filtration, Mexico has certainly been setting an example to the older cyanide regions, except New Zealand, which for the last two years seems to have led the way in tube-mill liners, air-agitation, and basket vacuum-filtration.

Other factors in Mexican practice are the large quantities of lime and lead acetate used for treatment purposes. It is a matter for serious question whether the use of lime is not carried to extremes, and whether some of the difficulties met with in the slime-treatment do not arise from an excess of lime. Thus at Guanajuato one of the companies feeds in 22 lb. of lime per ton of dry slime treated. At El Oro 15 lb. is used and at Dos Estrellas the practice is nearly the same. One of the results of this large consumption and solution of lime is the ever-present necessity of immersing the absorbent vacuum filter-leaves in dilute acid to restore their permeability.

Caldecott shows that lead acetate acts as a carrier, the eventual result being that the sulphur reacts on the cyanide to form sulpho-cyanide, leaving the PbO free for further action. I seem to remember investigating this matter in the laboratory some twenty years ago and coming to a somewhat opposite conclusion—based on the small amount of KCNS formed—but whereas in Australia very small quantities of lead acetate are used (say 2 lb. to a charge of 50 tons of roasted ore) in Mexico 16 lb. is used per ton of slime at Guanajuato, compared with ½ lb. per ton at El Oro, where crushing to 25 to 30 mesh takes place, with heated 0.03% KCy solution passing through the battery. Contrary to the Caldecott equation, Mexican chemists state that the amount of lead salt required equals the corresponding amount of sulphur present in solution from the silver sulphide dissolved.

In central and south Mexico they are blessed with cheap power; effective horse-power costs from £10 per annum at one district, to 10d. per day in another—less than ½d. per hour. A feature of practice at El Oro is the provision of well-designed, roomy, neat extractor-houses which are better than those I have seen in any other part of the world. The extractor-boxes are raised some little distance above the main floor, which is cemented with drains running to a pump-sump. All precipitate is sieved through a 60-mesh screen, and thus 'shorts' are kept out of the bullion, and acid treatment is avoided. The shorts, or roughs, are placed on trays in a special extractor-box and become fine at the next clean-up. Press precipitate is briquetted before fusion and makes a remarkably clean and neat product. Oil furnaces are in use, but tilting furnaces do not yet appear to have been adopted.

At Guanajuato large values have been carried

away in the slime-residue. During my visit residues containing 45 grams silver per ton, most of it in solution, were being run to waste down the creek. This does not mean that the men in charge were not keenly alive to what was being lost. The development of vacuum-filtration is recent, and though its spread has been remarkably rapid in Mexico it is not yet universally adopted. These residues when put through a Ridgway filter were impoverished to 13 grams silver, no dissolved silver remaining.

In Africa attention has been mainly devoted to lessening working costs, and the extraordinary spectacle is now presented of mines running at practically half of their former outlay, and of mines that are the richest as well as the largest in that territory, and in the world, running at working costs, including mining, handling, and treatment, of only 12s. per ton. In mechanical details there is still that keen rivalry between the two leading groups which has done so much for the advancement of the Rand. The 'Gold Fields' lead in their now universally adopted development of huge mills and heavy stamps. Already the output is stated to have grown to 9 tons per day per stamp (Luipaards Vlei, 'Gold Fields' group, 1650-lb. stamps) and the limit is not yet reached. The Simmer Deep mill of the same group has 1670-lb. stamps, capable of being weighted to 1800 lb., and it looks as though it would not be long before a falling weight of 2000 lb. will be reached. On the other hand the mechanical genius of the Rand Mines group has been evolving some interesting results on peripheral discharge with tube-mills, and has been displacing the wellnigh universally adopted tailing-wheel by centrifugal pumps of special design and local manufacture. Metallurgically the Gold Fields people have also done exceedingly well. Caldecott's forecasts of tube-mill results, as I have previously pointed out, were confirmed most remarkably in practice, and now he seems to be hard at work evolving a filtering process for the treatment of slime.

In Australia interest has centred on flotation processes for concentration, rather than on improvement in gold-ore treatment. Kalgoorlie seems to have reached its zenith, and to have settled down to steady practice. The treatment-costs given in detail in my review of 1906 still apparently hold good. The Ivanhoe costs for August, 1908, are 7s. 6d., as against 9s. in 1906, and those of the Great Boulder for the same periods are 11s. 6d., as against 11s., but, on the other hand, the other companies then mentioned—the South Kalgurli, the Great Fingall, and the Sons of Gwalia—show higher costs on the same basis. This reference to the Ivanhoe brings to mind the old controversies over roasting as against bromo-cyaniding (now dead), and pans as against tube-mills, in which this mine formerly figured prominently. It now appears, from local records, to have been at that time making particularly poor extractions—which tends to discount the low costs published—and a local metallurgist from Oroya-Brownhill, E. S. King, has recently sustained his claim at law for a large sum as recompense or fee for helping them out of their difficulties.

American practice seems linked with that of Mexico (largely controlled by Americans), and so the last year has been chiefly a chronicle of air-agitation and vacuum-filtration, as in Mexico, with much newspaper fulmination and advertising of rival filtration processes, and with the local success of the Merrill pressure-filter in South Dakota to offset the work of the Burt at El Oro.

Agitation. One of the features of the year has been the success of the Brown system of agitation, originally brought out at Komata, New Zealand, and adopted by the Waihi company. The latest and largest plants in Mexico and in the United States have adopted this system, which has now penetrated into Africa and South America. Daue has recently written a remarkable comparison in the *Mexican Mining Journal* for October, and shows at the San Francisco mill at Pachuca a consumption of only one twentieth of the horse-power used at the mechanically agitated Loreto mill, the Brown agitator showing considerably better extraction with a cheaper plant and giving a much shorter cycle of operation. The whole article is worthy of careful perusal. It seems abundantly proved that a charge of 80 tons (dry) of slime can be kept in a condition of efficient agitation for a consumption of 1½ horse-power.

Much time has been spent in Mexico in endeavoring to improve the mechanical agitator by the use of footstep bearings with mercury seals and other devices, but the mercury seals in practice have proved unreliable and have manifested a considerable tendency to the formation of base amalgam, as one would anticipate from the behavior of this metal in amalgamating pans. Owing to the well known refractoriness of silver sulphide ores, the agitation periods are much longer in Mexico than elsewhere; indeed, 48 hours of mechanical agitation is not uncommon—a practical impossibility in any country where power is not extraordinarily cheap. Daue, in the article mentioned, shows that at Loreto the ore requires 84 hr. of agitation, whereas, with the same class of ore at the San Francisco, the period of agitation is reduced by the use of air-agitation to 24 hr., for a lessened cyanide consumption.

Vacuum-Filtration. Undoubtedly the feature of the year has been the success of vacuum-filtration. With such a combined host of talent as Nichols, Thompson, Moore, Barry, Ridgway, Brown, Nutter, Cassel, Butters, Hunt, Parrish, Argall, Ogle, Leslie, and Caldecott, and I know not how many others, vacuum-filtration could scarcely have failed to accomplish great things, and already five continents are eagerly investigating it with a view to adopting the practice in one form or another.

Even if we assume only 1,000,000 tons of slime handled by this process during the last year, it would still be a remarkable figure for a new method, but, on the data given, the Ridgway and Barry machines alone must have handled over half this amount, and therefore the total tonnage treated by the various methods, notably the Butters, must considerably exceed this. But in addition to the two methods first mentioned, the Butters filter can fairly claim to be a great factor in present-day practice. That it has

achieved this position is surely a tribute to the energy, push, skill, and remarkable engineering ingenuity of the man at the helm and of his associates. So attractive and so simple does the filter look that nothing seems easier than to run in the slime at one end, turn a handle, and have the pulp running away at the other end, with the gold solution pouring into the precipitation-boxes. Ridgway, in Australia, not content with the success of his flat-plate machine, has been trying to make a larger unit by substituting a basket for a flat plate, thereby largely increas-



Liberty Bell Mine.

ing his filtering area. I am not sure, however, of the soundness in practice of his later idea, of which one hears most laudatory accounts from disinterested sources in Australia. The principles governing the discharge of a flat-plate and of a vertical plate are not entirely the same, and it looks as if the combination type must sacrifice something of the



Camp Bird Mill.

rapidity of the Ridgway and of the elasticity of the basket type for the sake of the greater capacity per unit.

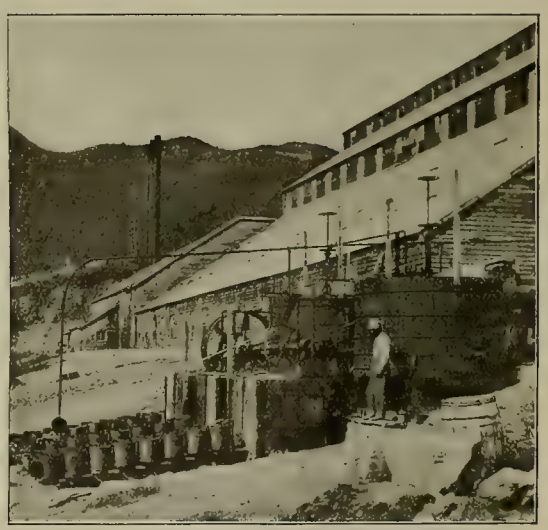
For automaticity can only be gained at the expense of elasticity, and hence it happens that the prettily running, apparently ideally simple Ridgway, with its perfect wash and its huge output per unit of filtering surface, needs for its effective working a strict adherence to the principle on which its design is based. The duty of a filtering machine is based on the amount of water or other fluid drawn through. The cake formation of residue is a sequel or a by-product, although for us it may be the all-important matter of tonnage treated per diem. Now, in a rapid-working machine like the Ridgway, it is evident that the amount of solution drawn through is mainly a function of time of immersion and not of amount of 'clog' or lessening permeability of cake.

Assuming, then, that a standard Ridgway has a solution-drawing daily capacity of 50 tons plus wash, then when treating the 50% pulp for which the Ridg-



Slime Plant at Homestake Mill.

way was designed, it follows that 50 tons of solution drawn through leave as a deposit on the plates 50 tons of residue. If, however, a pulp of 66 or 75%



Experimental Plant at Taracol, Korea.

moisture is being handled, then 50 tons of solution drawn through leave behind only 27 or 17 tons, respectively, of slime-tailing as a daily output.

It has become evident that for the successful working of automatic machines it is necessary to adhere rigidly to the condition of pulp thickness. With semi-automatic filters such as the Barry, Butters, Cassel, and Moore types this is not of so much moment. Here flow is a function of 'clog', as the cakes must be thick enough (four to eight times thicker than the Ridgway) to strip off a vertical frame. Possibly the last ⅛ in. of cake deposited takes 64 times as long to form as the first portion or section of similar

thickness, and thus if the solution is dilute one merely allows the cake a longer period of formation—it may vary from five minutes to one hour or even more—and adds a few more frames to make up for the greater time taken. The moral of this appears to be that if one wishes to use an automatic machine one must either have a 50% pulp or provide a suitable thickener, such as the Dorr, or settling-vats for this purpose. In Western Australia they find no difficulty in handling a pulp containing 55% solids; this is obtained by a constant flow from the first line of pointed boxes and an intermittent flow scraped down by a shovel from the second and third lines. In Africa in their settling-vats a pulp of similar thickness is encountered, but does not run with the same readiness. The more flocculent a pulp the greater percentage of moisture necessary to make it mobile. At Guanajuato we obtained a slime pulp by settlement so thick that it would stand up in ridges—like custard—after being stirred, and would not flow freely, and yet it contained 66% moisture.

Again, there is weathered slime so full of acid salts that gelatinous precipitate is formed on the addition of the alkali necessary to economical cyanide treatment. Success may scarcely be expected with this pulp from any of the automatic or semi-automatic methods employing filter-cloth, unless such salts are first removed by washing. Sand-filters such as the Hunt might be more successful, owing to the constant removal of the upper sand surface and the consequent automatic maintenance of an unclogged filtration surface.

Of the other methods, Moore's would probably have been more widely adopted but for the claim of patent rights over all submerged filters. When were filters not submerged? But more active business methods have during the middle portion of the year led to the securing of some contracts at Pachuca, Guanajuato, and Chihuahua. The process is necessarily more expensive to install than the Butters, but it has equal elasticity of treatment and the advantage of depositing on the dump nothing but washed tailing.

Barry avoids many difficulties by his special frame made of pressed corrugated sheet metal. There is no absorbent material inside the cloths, nor has he distance-pieces of wood on the face of his frames to offer resistance to the stripping of the cakes. His method is similar to the Moore, but differs in not necessitating a reversal of flow for discharge, and in permitting efficient agitation of pulp in the filter-vat. Then there are the pressure-filters of the Merrill and Burt types. I understand the former is still reeling off records merrily under its special conditions in South Dakota, but it is said to have been a failure in Mexico during the early part of this year—possibly the fault of local conditions. Burt is taking advantage at El Oro, as Merrill did in Dakota, of a gravity feed for his suspended-frame type of pressure-filter. It is difficult to understand how such a filter can wash its product prior to discharge. It was admitted to be discharging an unwashed output at both the mines at which it was installed in Mexico at the time of my visit.

Roasting. No improvements in roasting furnaces seem to have been made. The new Edwards furnaces have apparently given considerable trouble at the Lancefield, and they have been modifying the position of the auxiliary fire-boxes. The increased length seems to have tended toward the production of an unhandy unit.

Crushing. In Mexico the demand for an installation without stamps is continually heard. At one well known mine the Huntington mills installed were unjustly damned. Elsewhere poor success with Ferraris ball-mills is reported, and so the cry is for a simple installation using wet-crushing rolls. At Pachuca Capt. Narvaez is running Chilean mills, 8 ft. diam. by 16-in. face, with some success. These machines are of the slow-running type, making 10 rev. per min.; each wheel was stated to weigh 10 tons. For a consumption of 10 hp. each mill crushed 15 metric tons per diem from 1½-in. cube to a pulp 80% of which will pass through 200-mesh, at a cost, including 10% depreciation, of 70 centavos, or 17¼cv. per ton; but I noted that this was on soft ore ('fines'); the hard rock was fed to ball-mills, and then to a tube-mill and crushed dry.

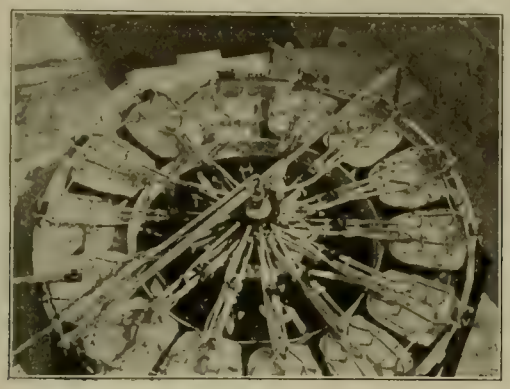
Reference has already been made to the installation of heavy stamps on the Rand. Mr. R. G. Fricker of the Gold Fields group, presiding at the recent Simmer & Jack meeting, showed that, largely as the result of using tube-mills, they have increased their profit on 7.6 dwt. ore from 12s. 9d. to 16s. 1d., or the addition of 3s. 4d. per ton, which shows a remarkable gain, attained entirely by increased extraction and lessened costs. He added that the introduction of tube-mills had had a marked effect on the mining conditions of the Rand, second only, perhaps, to the application of the cyanide treatment many years ago.

The following are some of the early tube-mill results: Redjang Lebong, without tube-mills, screen 35 mesh, output 2.85 tons per stamp per diem, extraction (sand) 79%; with tube-mills and 16-mesh screening, output was raised to 3.6 tons per stamp per diem, or 27% increase, for an 85.3% extraction. This ore is very hard.

Robinson Deep, with two tube-mills per 200 stamps, increased the output by 10%, and the profit by 1s. per ton milled. These examples of early results are given because they were obtained prior to the period of the use of lode-matter in place of pebbles for crushing and for liners. This later practice, modifying as it does both the power and the output, tends to complicate comparisons. Generally the tendency is to reduce the larger outputs per tube-mill obtained in 1906, and to use more power, so that already on the Rand the point has been passed where it is cheaper to increase output by tube-mills instead of by stamps. Ninety horse-power is now used for a 5 ft. 6 in. by 22 ft. tube-mill for an output of 140 tons per day, crushing through 60 mesh. But the increased extractions and the much lower residues, which have been reduced from 0.4 to 0.15 dwt., are tangible evidences of the claim for the present practice that the higher extractions obtained by the greater power employed are also the cause of higher actual profits. They do not appear on the Rand to have improved on the

costs of 5.71d. per ton of ore tube-milled, given in this review two years ago.

At El Oro, at first sight the impression is that the tube-mill is not being pushed to its full capacity, and that the horse-power consumed is high in proportion to the output of 1.1 to 1.2 tons per hp.-day. These figures do not shine in comparison with those of the Waihi, which also has a very hard ore, given in these notes for 1906, namely, an 18-ft. mill grinding 77 tons



The Ridgway Filter in Plan.

of 20-mesh sand per diem so that 93% passes 150-mesh, with a consumption of 37½ hp., but on closer comparison it appears that the classifying at El Oro was more thoroughly done than at Waihi, so that less actual slime is fed in the sand to the mills; that the standard of crushing at El Oro is somewhat finer; and that El Oro has done away with the use of pebbles and crushes with ore-lining entirely. Moreover, the El Oro policy of having a strong reserve of tube-mill capacity makes not only for comfort in management but in the ability to cope with the unexpected, and elasticity in treatment-method is probably responsible for the many accepted improvements in



Zinc-dust Precipitation Presses.
Showing part of cake in place at time of clean-up.

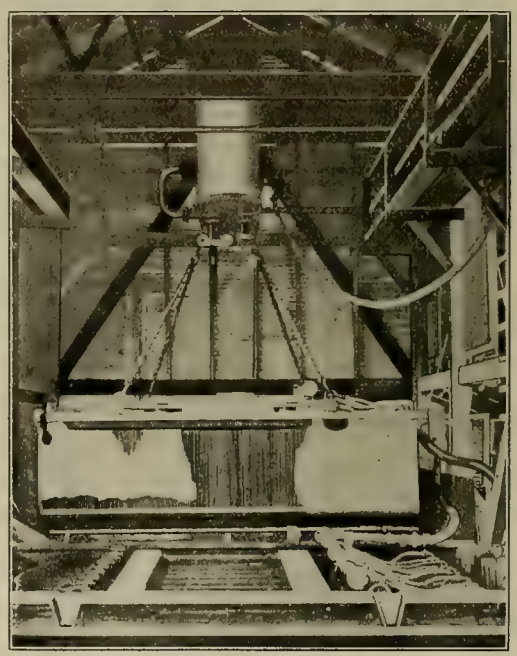
tube-mill practice which have come to us from El Oro. These are referred to later. They certainly have taken nothing for granted there, but have worked out their practice for themselves. At no other mill probably can be seen such a variety of tube-mills as at El Oro. In addition to two tube-mills of a make not preferred, they have five tube-mills of a well known make, three No. 3, one No. 4, and one No. 5, the size preferred being the No. 3, 4-ft. diam. by 19 ft. long. The Waihi tube-mills are 5 ft. diam. by 18 ft. long, and, like those at the Knights Deep (Consolidated Gold Fields), are smaller than the usual Rand Mines standard of 5 ft. 6 in. diam. by 22 ft. long.

At El Oro for some time they used a special self-



Tube-mill in the New Plant of the Goldfield Consolidated.

filling cast-iron liner, previously mentioned in these notes, into which the flint pebbles jammed. This liner, however, is not so suitable for the use of vein-



The Ridgway Vacuum-Filter.

matter, which has not the same jamming capacity as flint pebbles, and I therefore anticipate a modification of El Oro practice in this respect, as rough 'cubes' or otherwise irregularly shaped pieces of rock are not so amenable as pebbles for this purpose. About 53 lb. of rock in the form of 3-in. cubes is fed into the mill per ton of sand ground, and this abrades 0.2 lb. of cast-iron liner, the chips and frag-

ments of which are separated from the slimed sand by a 20-ft. blanket-strake. Silex linings were found to have a life of 2½ months.

An ingenious device has been used at El Oro and Dos Estrellas, called the Neal discharge, which practically maintains an open end, through which the cubes, and at Dos Estrellas the rocks, are fed by belt, by chute, or by hand, as desired. The device is remarkably simple, and consists of an internal annular ring, or baffle, around the orifice, with or without a reverse-worm. This retains all pebbles, while permitting the egress of slimed pulp. I have referred before to the Barry lining, the cost of which at Waihi (fine sliming of hard ore) is 0.72 pence, or 1.4 cents, per ton of sand slimed. In Africa they appear to be still using local or imported silex at an apparent cost for coarse sliming of only three times this amount. In a recent paper Mr. Graham refers to "the set of 6 by 6 by 4-in. silex blocks put into our Davidsen mill with diamond cement, that has now run 165 days," which shows a vast improvement over former wear. They use a feed of 4-in. cubes, and Mr. Graham maintains that 8-in. lumps would reduce the effective life of the smaller lumps.

Not much has been heard of peripheral discharge, of late, but in Africa I was shown some remarkable results of tests made by the Crown Reef, using a Danish (peripheral discharge), German (ordinary trunnion discharge), and a local-type mill. At the first trial the local mill gave the lowest results, and was not further compared, but three tests were made of the peripheral mill against the ordinary trunnion-discharge, with the following results:

Trial No. 1.	Peripheral.	Trunnion.
Size of nozzle, inches	1¼	1¼
Rev. per min.	26	28
Peripheral speed, ft. per min.	408	425
Feed, tons per diem	251	260
Percentage of water	44	47
Discharge, decrease of + 60	43	31.5
Discharge, increase of — 90	42.2	25.4
Trial No. 2. (The nozzles of the two mills were changed.)		
Size of nozzle, inches	1¼	1¼
Rev. per min.	26	28
Peripheral speed, ft. per min.	408	425
Feed, tons per diem	260	251
Percentage of water	47	44
Discharge, decrease of + 60	67.7	45.9
Discharge, increase of — 90	49.3	41.8
Trial No. 3.		
Size of nozzle, inches	1 1/16	1
Rev. per min.	26	28
Peripheral speed, ft. per min.	408	425
Feed, tons per diem	278	259
Percentage of water	35	35
Discharge, decrease of + 60	59.9	48.5
Discharge, increase of — 90	51.4	44.5

Thus is shown both a greater tonnage and finer grinding for the pheripheral discharge.

I understand that a further test of a year's duration has been made at the Ferreira, and that, as a result, it has been placed beyond doubt that peripheral discharge gives better results than the ordinary straight-through trunnion-discharge. It will be noted that in the above tests no mention is made of flint charge or power taken. Peripheral discharge involves a loss of 4 to 5 ft. in height, and thus will necessitate re-elevating for all mills laid down on straight-through lines which may be converted to peripheral discharge.

Concentration. The flotation methods appear to be causing a great amount of litigation. First we had Potter *v.* Delprat, and now we have the Elmore *v.* The Mineral Separation Co. The latter companies both claim success at Broken Hill on lead-zinc ores, but at Avino in Mexico, and at Cobar in Australia the Elmore process has not, under the local conditions prevalent, proved successful in practice. Of the mechanical concentrators, the Wilfley table still appears to hold the field, though I noticed a growing preference in Mexico for the Johnston vanner. Nothing appears to have yet been introduced capable of supplanting the plain table, whether of boards, canvas, or cement, for concentrating gold-bearing slime.

Slime Treatment. As under the heading of vacuum-filtration this subject has already been discussed, I may here summarize the present position by stating that in Africa decantation is still almost the universal method, but it is becoming evident that the days of this process, hugely expensive to install and incomplete in results, are drawing to a close. The recent admission that 7d. to 8d., or more, of dissolved gold per ton was being run away with the slime tailing, has promoted investigation into other methods of treatment. Dehne filter-presses, the Ridgway filter, and one or two other schemes have been put into practice or set to work on a practical scale, and in addition another method, known as the Adair-Usher, has been largely before the public eye. In America vacuum-filtration bids fair to completely throw out decantation and all other methods, though two advocates of pressure-filters are making a fight for it. In Australia filter-pressing still holds the field, but the Ridgway has some installations of considerable magnitude in operation, and the Cassel method has also been introduced at the Lake View. In India it has become obvious that the old method of taking advantage of the climate to deal with the sand and slime mixed must give place to some direct means of treatment, and the Ridgway has been installed on two fields for experimental investigation.

In eastern Asia a large Ridgway installation has been laid down where previously filter-pressing held the field, and another similar plant has also been acquired by another group, previously wedded to filter-pressing. It looks, therefore, as though decantation on the old lines, and even filter-pessing, is doomed to disappear, though in a less expensive guise decantation may still remain to form a portion of a more thorough process.

Adair-Usher. I looked into this process during my visit to Africa, in view of the great amount of publicity given to it by the technical press, and the great success and general adoption advertised. I have already referred to the lack of success attending upward percolation of solution and wash-water, as investigated by Holms in Mexico, Ward at Kalgoorlie, and Hunt in Costa Rica—did not Godbe patent this several years ago in the United States of America? At the first mine to which I was taken on the Rand I saw dirty solutions coming off from the vats

—surely evidence of poor work. At another mine, however, the Ferreira, I found a much better condition of affairs. There the metallurgist had apparently realized the impossibility of obtaining good extractions or of running off clean solutions by continuous upward percolation, and consequently he treated the process as merely an adjunct to the decantation process, to save a final transfer. He pumped his slime into collectors in the ordinary way, settled, decanted the water, and then transferred with dilute cyanide solution to the agitator-vats. After agitation for five hours the pulp was transferred to the Usher vat (an ordinary vat provided with a radial system of perforated pipes along the bottom), weak solution being fed through the perforated pipes during the charging, and indeed until the charge is 6 in. from the top of the vat or the decanter. The charge was then settled until the upper portion was quite clear, and then the solution was turned on through the radial perforated pipes at the rate of 10 to 12 tons per hour; this is for a 150-ton charge. This flow of solution was maintained for 36 hr. out of a total treatment time of 72 hr. The solution was then cut off and the charge allowed to settle, the solution being decanted to the agitator-vats. The Adair-Usher process thus becomes merely a method, not of solution, but of avoiding, with the aid of decantation, a final transfer. It has the advantage of saving the cost of one transfer (2½d., or 5 cents), and of leaving the washing-vat free for other use. But as a matter of practical economics it is possible only in such a process as South African decantation with its huge plant, heavy pumping charges, and necessity for treble handling. It largely increases the bulk of solution to be handled—5 or 6 of solution to 1 of dry slime—and sends to the dam an amount of solution carrying not less than 4 to 6 grains of dissolved gold per ton, at least equal to the weight of the tailing discharged. From careful enquiries I could find no gain in extraction or decreased value of tailing resulting from the use of the Adair-Usher wash, but a saving of time and of vats from the avoiding of the final transfer and wash. In a word, as a solution-process the Adair-Usher seems to be no more feasible than the upward percolation tried elsewhere, and to have the same liability to mingle rather than to displace, and the same necessity for the employment of much solution, all taking up KCy and gold. Actual displacement indeed has not yet been recognized. On the contrary, alteration in 'head' or the slightest increase in heat of the solution pumped into the Adair radial pipes, causes an ascending stream through the pulp.

Clean-Up. I have referred elsewhere to the neatness of the Mexican clean-up plants based on absolutely the old safe lines of fine sieving and avoiding acid treatment and roasting. I am rather surprised that no one has tried T. K. Rose's method of purifying base bullion, and even precipitate, by introducing oxygen or air into the melt through a pipe-stem. Full details of this method were given in a paper presented to the Institution of Mining & Metallurgy, and from a demonstration in my presence it seemed that this process was most simple, even on base metal.

COPPER RIVER, ALASKA.

The U. S. Geological Survey issues the following interesting notes:

Active prospecting in the Copper River region was carried on in 1908 at the head of Nabesna river, on Cross creek (or Copper creek, as it it now called), and on White river. The White river prospects are situated in two areas—one at the head of the river, in the vicinity of Skolai glacier, the other near the international boundary line, partly, it is supposed, in Yukon Territory.

Prospecting in the region northeast of the Wrangell mountains is restricted almost wholly to the search for copper, although gold has been found at a number of places. The best known copper prospects on Nabesna river are near the foot of Nabesna glacier, in the vicinity of Orange hill, but development work is not yet sufficiently advanced to give an idea of their extent. At a gold deposit on Jacksina creek a small stamp-mill was erected in 1906 and about 60 tons of surface ore were crushed.

The copper minerals on Copper creek are found in lavas and consist chiefly of the sulphides, chalcopyrite and chalcocite, but include also cuprite and native copper. The copper deposits of White river consist of copper sulphides and native copper in lava flows. Native copper is found in greatest amount near the boundary line.

Prospecting in the Chitina valley was discouraged during 1908 by the low price of copper and the consequent difficulty of obtaining financial backing, but some effective development work was done. At the Bonanza mine the season was spent in erecting a sawmill, ore bunkers, buildings for various purposes, and an aerial tram from the mine to the camp. Development work was done on the extension of the Bonanza in the upper part of McCarthy creek by the owners of the Mother Lode claim and by the Houghton Alaska Exploration Co. The largest operations in the remainder of the field were those of the Alaska Consolidated Copper Co. on Nugget creek, the Hubbard Elliott Copper Mines Development Co. on Elliott creek, and the Great Northern Development and Alaska Kotsina Copper companies on the Kotsina river.

Probably the most important work affecting the future of the Copper River region is the construction of the railroad from Cordova to the interior. During 1908 more than 50 miles of track were laid, bringing the road to the bridge over Copper river between Childs glacier and the lake in front of Miles glacier. This road will establish steamboats on the river above Abercrombie rapids and it will be possible to carry freight from the coast at Cordova to Copper Center on Copper river or to the mouth of Lakina or Nizina river on the Chitina. Construction work is also being pushed on a short piece of road connecting the Bonanza mine with Chitina river, and its completion will make it possible to carry supplies to the mine or to ship ore to the coast before the whole of the railroad up the river is completed. A branch line to the Bering River coalfields is also under way.

SILVER PRICES IN 1909.

Written for the MINING AND SCIENTIFIC PRESS
By THEO. F. VAN WAGENEN.

The prospect for any large recovery in the price of silver in the near future is not bright, but there seems to be warrant for expecting a moderate advance within the next sixty or ninety days. In forming an opinion, or endeavoring to make a forecast, in this matter, perhaps the first step is to discharge from the mind the numerous stories afloat on the subject in the financial columns of the daily and weekly press. All such are doubtless set in motion through interested motives, and are not entitled to credence. Undoubtedly speculators are able occasionally to cause temporary abnormal fluctuations in the price of a commodity, but they must work with the actual ebb or flow of the tide to attain success. The next step is to examine the statistics of silver, its production and consumption, and apply to the problem the natural and well known laws of trade. The final element to be considered is the political one, for wars of any size, or conditions of unrest that generally precede them, by altering the rates of production or consumption, become factors in the determination of prices of staples.

The world's production of silver in 1907 was 6634.4 tons of 2000 avoirdupois pounds. This was an increase of 384 tons above the output of 1906. Seventy-eight per cent of the production originated in North and South America, 10% in Europe, 9% in Australia, and 3% in Asia (mainly Japan). From the best information at my command, not less than 85% of the whole amount arose as a by-product in the working of copper, lead, and gold ores. As the demand for these is strong, it may safely be inferred that there will be at least no material reduction in the quantity of silver produced during 1909. So much for the matter of supply. Now as to demand.

For scores of years past, Asia, mainly Hindustan and the Malay peninsula, has continuously absorbed fully 50% of the world's output. About 35% has of late years been bought by European and American governments for the production of new subsidiary coins, and the remainder has been consumed in the arts. There seems to be no probable call for any large amount of the metal from any other direction. India and Malaysia are as capable as ever of absorbing silver. The former, in fact, is advancing notably in commercial strength, and tin, which is the mainstay of farther India and the Straits Settlements, is firmly in demand. Throughout the civilized world (by which is meant Europe, North and South America, Egypt, South Africa, Japan, the Philippines, Australia, and New Zealand), the population is increasing, and new coinage is constantly needed. For a like reason the consumption in the arts is steadily growing. Hence, other things remaining the same, there is reason to believe that the demand during the coming year will be equal to the task of absorbing the supply, even if the latter should show an increase.

The problem then is reduced to the query: Will other things be equal? Are the conditions during 1909 liable to be normal? Here enters the political element. What unusual thing may happen in international politics during the next twelve months? One important factor is certain. Wars not only cost vast sums of money, but they involve the destruction of an enormous amount of property, and in these days, when the financiers of the world are interested in commercial ventures almost everywhere, they become the real rulers; these are the men who decide whether wars shall or shall not take place. If England had needed to borrow money outside of her own people, she would not have been able to sell bonds to carry on the enterprise of South African conquest. If the Russo-Japanese conflict had been elsewhere than in distant Korea or Manchuria, where few foreign interests were affected, neither combatant could have raised the necessary money in Europe or America. There will be no wars in Europe. India, though full of unrest, will not be allowed to lapse into rebellion. Trade is King, wherever international trade exists. The business men of all the commercial nations insist upon its protection. Meantime the millions of Asiatics must live and consume, and to do so they must toil and export, and their exports must largely be paid for in silver. Normal political and social conditions may be anticipated during 1909, and the Orient will, as usual, absorb from 2500 to 3500 tons of the white metal.

The financial prophet has one more oracle to consult. That is the record of past fluctuations in the price of the commodity under consideration. Complete and accurate statistics as to silver for a number of years are available. These are embodied in the accompanying diagrams. Fig. 1 gives the average annual price of the metal since 1840. Fig. 2 gives the average monthly price during the last seven years. An inspection of the first seems to show that, after the tremendous depreciation caused by demonetization in 1873, production and consumption came again into approximate balance about the years 1894-97, since which time the fluctuations, though occasionally severe, have been due to normal variations in the general conditions of international trade. During the last 15 years the mean value of the metal, as shown by this table, has been 60.6 cents per fine ounce, with extremes of 52.16 and 66.8. The second shows a mean of 59.23c. per oz. for the last 7 years, with extremes of 47.5 and 71. The two exhibit close agreement, and it seems a proper conclusion that the normal value of silver, under international conditions as they have existed for the past 15 years, is about 60c. per ounce. As the year has closed with quotations ranging under 50c., an advance in the near future should occur. The advance during 1909 should be quite rapid, approaching 60c. before its close, with the promise of fairly steady prices during 1910-11, and a spurt toward top figures of 70 to perhaps 75c. in 1912. Beyond 75c. as an extreme, I see no chance for the white metal until the opening of China to the commerce of the world becomes effective, unless meanwhile, as would be

most wise, the chief commercial nations, acting together, should standardize their silver coinage, so as to prepare themselves for the coming day when the East will awake in earnest and begin to produce, and to force its products upon Western markets. The Orient wants silver, and will take nothing else. The Occident has it, and to spare. It would look then as if it might be good policy for the latter to consider ways and means for strengthening the selling price of a commodity that it would be glad to dispose of in large quantity, and for which it is likely soon to have a buyer.



Fig. 1. Price of Silver from 1840 to 1908.



Fig. 2. Price of Silver from 1902 to 1908.

MINING INDUSTRY OF THE MIDDLE WEST.

Written for the Mining and Scientific Press
By an Occasional Contributor.

A distinctly hopeful tone pervades the mineral industry of the Middle West at the close of what has been admittedly a bad year, although not so bad as was expected twelve months ago. In fact, a gain has been made in many lines; others have held their own; only a few have fallen behind. Business has been steadily improving. During the first week in December more cars and fewer empties were handled in and out of Indianapolis than for the corresponding week of either 1907 or 1906, and, as compared with any but 1907, the year 1908 has been regarded as extremely satisfactory. Pittsburg reports the pig iron production of the country for November to have been 1,580,444 tons, with 10 more furnaces in blast than in October, and 7 more about to start.

In Illinois, for the year ending June 30, 1908, the coal production was 49,272,452 tons, as compared with 47,798,621 tons for the year ending June 30, 1907. For the calendar year, the output has been maintained, if indeed a slight gain was not made. This, in the face of the prevailing business depression, is worthy of remark. It is doubtless due to the enormous expansion that our coal industry is undergoing, amounting during single years to a growth of over 25%. This year the natural growth, largely in sales of domestic coal and fuel for heating, lighting, and traction plants, offset the decrease in demand for railway and manufacturing purposes. In Iowa, where factories take a still smaller portion of the output, the depression was felt even less.

The year has seen the opening of more coal mines in southern Illinois despite the present excess of capacity over market. The new plants are excellently designed, steel top-works now being the rule, and the permanent plants being of much higher grade than those installed a few years ago. This is necessary owing to the larger outputs handled—2000 to 3000 tons in 10 hours—and the greater depth of the mines. Unfortunately less attention has been paid to adapting underground systems to the new conditions. There is entirely too much of a disposition to use the same methods and men as in the shallow outcrop mines, despite the greater risk of fire and explosion. As a result, an increasing number of serious accidents has occurred. In November, within one week, in a single district not more than a dozen miles across, the Rend mine exploded and killed four men, the accident being followed by an underground fire; the Zeigler mine had a serious fire which, because of the absence of a panel system, spread so rapidly as to require sealing of the mine; and finally, the Benton mine blew up. Now, within a month, a second explosion has occurred in the Rend mine, due, it is stated, to escape of gas from the sealed off burning part of the mine. Evidently better skill is needed in this field, and not unlikely the Legislature will be asked to modify the mining law to meet the new conditions.

In the meantime arrangements have been made for the U. S. Geological Survey to establish at the University of Illinois a branch rescue station for training men and furnishing apparatus for service at explosions and mine fires. Messrs. Paul and Rice, of the Pittsburg station, assisted at Zeigler and Rend, using the Draeger oxygen helmets. Their services were so valuable that a demand has been made for a branch station to serve the Illinois, Indiana, Michigan, and western Kentucky coalfields. It is understood that the University will furnish the building, including a gas chamber for practice training, and the U. S. Geological Survey will furnish the portable apparatus and detail a mining engineer to take charge. The Operators' Associations will furnish two men per week from the various mines to receive the training and to assist in case of an emergency call. It is expected also that all Mine Inspectors will become familiar with the work, and that ultimately all the larger collieries will be equipped with rescue apparatus.

G. W. Traer, president of the Illinois Coal Operators' Association, has resigned his position as receiver of the Illinois Collieries Co. This ill-fated concern will be remembered as one of the creations of Robbins, of Pittsburg, who, during a boom period, bought out the Jones and Adams and a string of other nearly exhausted collieries in central Illinois. To these were added large coal-land holdings belonging to Minneapolis people. The attempt was made to pay interest on bonds representing the whole property and to get into the Northwestern market. The attempt was a failure, in part because of the natural competition in this market of the higher-grade coal of Mr. Robbins' other mines in the Pittsburg district. The management was changed, and Mr. Traer took hold, first as president, and later as receiver. He has made a good fight to maintain the property, but in the absence of railway affiliations a coal mine in the Middle West has a hard time. Mr. Traer brought suit before the Inter-State Commerce Commission and obtained a ruling compelling a much fairer car distribution than has prevailed. His presentation of the case was so complete and accurate that the railways made no defense and the Commission entered the ruling asked for. None the less, the time is too early for a large independent coal company to be successful in reaching the Northwest market, and it is understood that in future the Illinois Collieries Co. will be operated mainly for the local market.

Among miners, interest centres now upon the election of an international president of the United Mine Workers, in the place of John Mitchell. Tom Lewis, who followed him, seems not to have been successful. There has been open rebellion in Indiana and Pennsylvania, and serious trouble in Arkansas and in other States. It is said he has systematically tried to eject Mr. Mitchell's friends, and to create a personal machine within the organization. However that may be, he is regarded by operators as being demagogic and inclined to promise for effect more than he can accomplish. Since the United Mine Workers, including 350,000 of the 600,000 coal miners of the country, is the largest single interest in

the industry next to the anthracite coal operators, the election of an executive chief is a matter of wide moment. Mr. Lewis' opponent is John Walker, of Illinois, who is regarded as the true heir to the Mitchell policies and following. While Mr. Walker is an avowed socialist he is, singularly enough, the wiser and more conservative leader of the two. As one operator phrases it: "John doesn't let his socialism interfere with his common sense." He is everywhere recognized as honest and fearless. Present indications point to his election.

It is probably fortunate that no unusual demand for coal occurred this fall in view of the shortage of water. The washeries were mostly compelled to close and many mines could keep up steam only by hauling water. All tank-cars were put in service, and gondolas lined with rubber blankets were used. Freight and even passenger service was crippled, and locomotives limped along from tank to tank, taking a small drink here, a smaller one there, and a good one nowhere. Any kind of water was at par, resulting in numerous breakdowns, and in joy only for the makers of boiler compounds. In some towns the water was held by the Board of Health and given out under police regulations. The drought has been broken, but there is still a shortage in places; this raises serious questions as to what will be done when, as statisticians tell us will happen inside of a century, we have four times as many people to supply.

In one direction the water shortage was something of a blessing in disguise: it practically stopped drilling over much of the oilfield. Since tanks are full, and pipe-lines are taking over 60% of the oil offered, it manifestly is folly, collectively, to bring in new wells, regardless of the individual advantage. Only the widespread and rather unusual spirit of co-operation that has obtained in the Illinois oilfield, and the skill and energy of the local Standard Oil officials, have permitted the situation to be handled without a break in price. As it is, there have been only 15 days (early in June, 1908) since the field was opened when all oil offered was taken. This brought it out at the rate of about 3,000,000 bbl. per day, and the output for the year, despite all efforts to decrease production, will run 35,000,000 bbl., or better. The oilfields continue to expand. Within the year production has begun, at least in a small way, at Sparta, in the western part of the State. At Centralia an 18-bbl. well is being pumped in a wholly new district, and favorable showings are being obtained in other 'wild-cat' areas. It is reported that the Indian Refining Co., which has previously shipped to its plant at Georgetown, Kentucky, will build a large refinery at Lawrenceville, Illinois, near its wells. The Pure Oil Co. is completing an independent pipe-line eastwardly. On the whole, the Illinois oil industry is in a prosperous condition.

The lead and zinc smelters of the Mississippi valley have suffered throughout the year. The mines have kept up production fairly well, but it is doubtful whether they have made much money. The most significant change in the Wisconsin district has been the entrance of the U. S. Mining, Smelting & Refining Co. Interests affiliated with this company have bought the famous Empire and other good producers and have erected a large mill for treating the ore by a new magnetic process. It is noted, however, that they are also building mills of the old type with roasters. The Empire, by the way, on an initial investment of $30,000, distributed approximately $250,000 in dividends, and is said to have gone into the new combination on the basis of $100,000 in cash and 15% of the stock of the new concern.

The cement industry, closely dependent as it is on building operations, has languished throughout the year. The Sandusky Portland has taken up the contest with the North American over the Hurry and Seamon patents. This will be watched with interest, since the only possibility of monopolizing the cement industry seems to lie in the ownership of basic patents. It will be remembered that the Pennsylvania case was settled out of court on the basis of payment of royalties by the contestants.

Record progress in driving hard-rock tunnels was discussed in our issue of June 6, and it was there stated that the American record for machine-drilling was made in the Gunnison tunnel. That record of 449 ft., made in January, 1908, has now been exceeded in the Elizabeth Lake tunnel, a part of the Los Angeles aqueduct. For the 31 days ending at midnight, October 31, the south heading was driven a total of 466 ft. The Elizabeth tunnel is the opening by which the waters of the Los Angeles aqueduct will be carried through the crest of the Coast Range. The tunnel is to be 27,215 ft. long, of which 355 ft. is in open-cut, giving 26,860 ft. from portal to portal. It is about 60 miles north of Los Angeles, and the south portal is 24 miles from a railroad. The Elizabeth tunnel is 12 by 12 ft. in section and is driven in granite rock. It is interesting to note that the Elizabeth tunnel and the Gunnison tunnel were driven by day labor, under the direct charge of engineers of the Government and of the municipality. The Elizabeth tunnel was driven full size by the lower heading method with Model 6-A water Leyner rock-drills. The mucking was done by hand and the dirt transported by electric motors. The face, October 31, was 2508 ft. from the portal. The base rate in the bonus system employed is 8 ft. per day, or 248 ft. for a 31-day month. For each foot in excess of this amount each man working in the tunnel continuously during the month is paid 40c. Including the payment of the bonus, the month's run was made at a cost of $35.81 per foot, and at the rate of 15 ft. per day. The run of 466 ft. was made with modern tunnel equipment, consisting of two 520 cu. ft. Franklin two-stage air-compressors, each belt driven by a 100-hp., 440-volt A. C. induction motor which supplies air for the rock-drills and other equipment; one Fairbanks-Morse 100-kw. motor-generator set, supplyng direct current at 220 volts for operation of one six-ton electric locomotive, used in tunnel traction, and one No. 7 Root blower. This equipment is duplicated at the north portal. The work is in charge of J. B. Lippincott, assistant engineer to the Water Works, and W. C. Aston, tunnel superintendent.

COPPER MINING AT ELY, NEVADA.

Written for the MINING AND SCIENTIFIC PRESS
By COURTENAY DE KALB.

The name of Ely was not transferred from Vermont to Nevada. The classic little copper mine in the Green mountains, never large, but never exhausted, had nothing to do with naming the spot in the Steptoe valley that has risen suddenly to fame. Many years ago, the abundant water and excellent pasturage in this valley led to the establishment of a cattle ranch by one Ely from "down in Maine," and Ely's Ranch became simple Ely. In course of time, minerals were discovered. First came lead ore, containing silver. Lead is still mined in the district and is shipped to Salt Lake City. Next gold attracted notice. The Chainman mine once gave promise of acquiring a reputation, but the mill, dragged 140 miles from the railroad, has succumbed to rust instead of wear. This is at Lane City, on the road up the gorge to Copper Flat, the scene today of magnificent operations in the gigantic modern way. Close to this great open-cut is the Keystone copper mine, memorable only for a tragedy in which a mine manager shot four menacing workmen several years ago. This mine, like others around it, was a failure. A large dump betokens extensive workings underground; to the Nevada Consolidated Copper Co. this dump of gray slacking monzonite is commercial ore, and will one day go to the mill, when the excavations extend that far; to the Keystone capitalists it was 'waste,' and typified discouragement. It depends on the point of view what kind of an enterprise is set in motion. The disseminated ores of Ely to the first group of miners signified the possibility of enriched veins, from which they hoped a product might be obtained that would pay the enormous costs of old-time methods. The second group, urged by the courage and inspired by the foresight of Mark L. Requa, instead of seeking ore to match a method, adapted a method to the ore available, and the result is one of the greatest copper enterprises in the world. The shares of the Nevada Consolidated, which could be bought during the late panic at $6, are now close to $20. The capital stock consists of 1,600,000 shares, of a par value of $5 each. So clearly was the future greatness of the property proved that the capital stock and other securities realized a sum of $3,122,710 in excess of par value for the benefit of the company's treasury. The total capital liability on the books today is charged at approximately $14,400,000. This finds its warrant in a body of developed workable ore of 20,000,000 tons. The reserves blocked at present represent only a fraction of the area available. Prospecting by Keystone drills is proceeding rapidly; this is a swift and exceedingly economical method of prospecting. The ordinary drill, such as is used in testing auriferous gravel, is employed; the prospect holes extend to 300 and 400 ft., according to the topography, but the hole is usually started with a diameter of 10 inches, so as to finish at 6 in. The speed varies from 25 to 40 ft. per diem, and the cost ranges from 75c. to $1.25 per foot. This work is locally called 'scouting'. The testing already done shows an average copper content for the 20 million tons developed, of 1.9%, this being the figure stated officially by Pope Yeatman, the consulting engineer for the company.

The earlier testing of these deposits was done by the ordinary methods of shaft-sinking and level-driving. This was mainly at the Ruth mine, on the eastern side of the mass of impregnated monzonite. An account of the tests, and the vindication of the churn-drill method by its faithful agreement with sampling in many lots of several hundred tons in the Ruth mine, will be found in an article entitled 'Experimental Mill of the Nevada Consolidated Copper Company', by M. L. Requa, published in the MINING AND SCIENTIFIC PRESS of July 18, 1908.

The area of the ground owned by the Nevada Consolidated Copper Co. is 850 acres, consisting of 63 claims. Closely related for purposes of operation and treatment is the Cumberland-Ely, where 12 claims have been partly developed. The orebody there is narrow, and of higher grade, yielding from 3 to 4% copper. Associated with these companies are the Steptoe Valley Smelting & Mining Co., with magnificent works, still being enlarged, at the new town of Smelter, 22 miles away. Here water is abundant, and ample precautions have been taken not to become involved in legal embarrassments over fume. Finally, the Nevada Northern Ry. Co. was organized, and a line was built to the Southern Pacific at Cobre, 140 miles north of Ely. A ramification of shorter lines around Ely opens up the ore-producing territory and gives access to the works at Smelter. Each corporation is operated on entirely independent lines. Beyond these corporations lie other financial intricacies, the American Smelters Securities Co. holding indirectly a controlling interest on behalf of the American Smelting & Refining Co. Thus the enterprise constitutes a notable enrichment of the holdings of the Guggenheims.

The geology of the ore deposit was studied by Andrew C. Lawson, professor of geology in the University of California; a monograph entitled 'The Copper Deposits of the Robinson Mining District, Nevada', was published in 1906, as a bulletin of the Department of Geology in the State University. No preceding studies had interpreted the interesting phenomena presented at Ely. Under conditions that were practically those of a reconnaissance Mr. Lawson has done work that has stood the test of subsequent development, so that his report on this property has been a splendid example of the practical importance of the economic geologist. In brief, a mass, or batholith, of monzonite porphyry is found intruding Devonian and Carboniferous rocks, the latter consisting of limestone. The intrusive rock appears upon the surface at Copper Flat and at the Ruth mine. The area between is overlaid with limestone, and this covering exists continuously around the porphyry, portions of which are also overlaid by a more recent flow of rhyolite. This has raised the question as to the probable extension of the copper in workable amount beyond the limits of the exposed area, especially under the rhyolite capping. A concentration by secondary enrichment has resulted

from leaching where the monzonite has lain open to meteorological influences. The enrichment has been feeble, to be sure; nevertheless it has made all the difference between ore and valueless rock. The upper portion of the porphyry has been impoverished by leaching, and constitutes an overburden from 50 to 70 ft. thick, containing 0.75% or less of copper. The re-precipitation occurred at a former water-horizon which has since been lowered. Hence the change from the overlying oxidized lean rock, with its prevailing yellowish tinge, to the bluish-gray enriched ore below, is as abrupt as if the two had been artificially severed. Below this line of division, however, the copper content presently shows a decrease in depth, and the quantity gradually sinks to about 1 per cent. The depth to which extraction may continue depends, in consequence, upon the price of copper and the extent to which mining and reduction of the ore at Ely can be cheapened. An interesting phenomenon at Copper Flat is the vertical division of the deposit by an almost dike-like zone of silicious ore, out-cropping on the surface and cutting the deeper orebody. This contains copper to the extent of 3%, and even 4%, in the form of silicate and carbonate. It was originally suggested that this so-called 'carbonate' ore would need to be treated by a leaching process, but the metallurgists of the Steptoe Valley S. & M. Co. have done better than that. The proportion of silica is so high, being about 80%, that in this material, donated by Nature as a bonus with the mine, they have an ideal converter-lining. This cupriferous silica, available at certainly no more than 65c. per ton laid down in the works, is an important assistant in the economical treatment of these ores.

The method of mining adopted at Copper Flat is by steam-shovel. The adaptability of the steam-shovel was early foreseen, and it has fulfilled the expectations of those who fathered the enterprise. The cost of the ore in the cars ready for transportation to Smelter is about 40c. per ton, including its proportion of the cost of stripping overburden. The actual digging and loading costs only about 11c. per ton. One 70-ton and three 95-ton Bucyrus steam-shovels are used. The larger shovels, with 3½ cu. yd. dippers, equal to 7 tons of ore per dipper, will dig as much as 800 cu. yd. per day. A shovel-crew comprises an engineer at $175 per month, a crane-man at $125, a fireman at $90, and 6 pitmen at $2 per day. The cost of explosive used on the overburden will not exceed 4c. per cubic yard. A shovel will comfortably load 2500 tons in 9 hours, and it can fill one car of 55 tons in 4 minutes. The banks worked in the overburden are at present about 50 ft. high, and in the ore 40 ft. The open-cut is 800 ft. long by 400 ft. wide, and is being excavated in two benches, with railroad track making a loop around the head of the cut, so that trains always make the circuit, thus obviating loss of time from switching in and out of the loading places. Much of the ore is soft and requires little or no blasting, but the overburden is hard and needs shattering by heavy blasts. Holes for this purpose are drilled with Keystone churn-drills, using a 6-in. bit. No casing is required. The holes are placed from 25 to 30 ft. from the edge of the bank, and 30 ft. apart. The hole is first 'sprung', or chambered, with dynamite, from ½ to 2 boxes of 40% grade being used, according to the hardness of the rock. If the ground is relatively loose the hole is then charged with 60 kegs, of 25 lb. each, of Du-pont FF black powder; if the rock is firm and dense, the hole is loaded with 15 to 20 boxes of 40% dynamite. The volume moved by such a blast is approxi-



Mining With Steam-Shovel at Ely.

mately 2400 cu. yd. Work had been abandoned during the financial crisis, but stripping overburden was resumed in March. Since that time, approximately 300,000 tons of sulphide ore have been mined and shipped to Smelter. This applies only to Copper Flat, and is exclusive of tonnage shipped from the Veteran mine of the Cumberland-Ely. Drilling is proceeding westward to establish the persistence of the orebody in that direction. In horizontal distance these tests have shown its continuance 1800 ft. beyond the present open-cut, and the cut will have several banks or terraces below the existing floor. This will give an idea of the magnitude of the operations. It was hinted that banks 100 ft. high might be attempted, which would, of course, be in disregard of occasional mishaps, when a shovel and crew might be buried by a slide. No extraction of ore is taking place at the Ruth mine. The amount cheaply available at Copper Flat is enough to feed the mill, as it now stands, to its full capacity, and concentration of work and traffic at one point naturally affords superior advantages in regard to economy.

The Veteran mine, which is practically part of the same general scheme of operations in spite of pertaining to a company having a separate corporate existence, is an underground working. The overburden here is too thick to admit of stripping. That form of caving known as 'top-slicing' is being introduced. Enough has been done to demonstrate its applicability to local conditions. The ground is laid out by cross-cuts and lateral drifts in blocks 50 ft. square. Raises are then driven to the overburden at the four corners of the blocks. The slicing is carried across each 50-ft. block, and a floor of boards laid as the work progresses, to serve as a mat to hold the overburden when it settles, and to keep it from mixing with the ore below. The height of face on the upper slice is 8 ft., but the subsequent lower slices will be 10 ft. The next slice will be worked carefully under the broken overburden, the mat being caught and held in place by timber sets of 12 in. square caps, and round stulls of Oregon fir. As the system had only been introduced experimentally, no data concerning costs were available. Fifty experienced cave-miners had just been brought from Minnesota. The output of the Veteran is intended to be 1500 tons daily. Four of the 12 claims on the orebody will be worked from this one shaft. The charge made by the railroad on ore from the Veteran mine to Smelter is 30c. per ton in 300-ton lots.

A vertical 3-compartment main shaft, with manway, serves the Veteran mine. The compartments are 5½ by 6 ft., with one compartment 5½ by 9 ft. for convenience in lowering timbers. The shaft is surmounted by a wooden head-frame 110 ft. high, with 12-ft. sheaves over which run 1¼-in. steel cables. The total height of lift is 600 ft. Hoisting is done in automatic-dumping 5-ton skips made by the Atlas Car & Manufacturing Co. of Cleveland, Ohio. A cage is also used for raising and lowering men; this is operated by a special steam hoisting-engine, designed and built by the Exeter Machine Works of Pittsburg. The ore-skips are operated by a 300-hp. General Electric Co.'s induction motor, rated as 3-phase, type 1-14, form M, 60 cycle, for 290 amperes and 550 volts. The hoist itself was built by the Denver Engineering Works and has 6-ft. drums, working in counterbalance. A current of 40,000 volts is transmitted from the power-house at Smelter, and is stepped down to 600 volts for the hoist.

The geology of the region is of great interest, but the details are accessible in Mr. Lawson's published report, and will not be reviewed here. Attention, however, may be called to the fact that indications are favorable for the existence of contact copper deposits between the porphyry and the limestone; these possibilities have not been developed. It is expected, however, that ore available for blast-furnace smelting will be found. The limestone contains many large masses of silver-bearing limonite, which would furnish valuable flux for silicious copper ore. That the silver-lead and gold ores will be locally utilized in time seems probable. Developments are disclosing larger amounts of galena than had been previously suspected. These deposits constitute a distinct belt north of the monzonite, and lie in the Ruth limestone, which is the upper member of the Carboniferous rocks occurring in this district. The Ruth limestone is 500 ft. thick, and is underlaid by 1000 ft. of Arcturus shaly limestone, succeeded downward by 1500 ft. of Ely limestone. Thus there may be possibilities for lead-mining at considerable depths below the present known occurrences in the Ruth limestone. Some deposits of lead-ore are also being worked in a small way on the great ridge that separates Steptoe from Duck Creek valley. These small mines, which are now shipping ore to Salt Lake City, are almost directly above the reduction works at Smelter. The gold deposits are confined to the Paleozoic rocks, which are represented by 1000 ft. of White Pine shale, on which the Ely limestone rests conformably. Below this comes the Nevada limestone, at least 1000 ft. thick. These are of Devonian age. The gold ores are often basic, and to some extent may be used as flux if blast-furnace smelting should develop at this point, and it has been hinted that some concentrating gold ore exists.

Surrounding the great mines are others of varying promise. The Giroux Consolidated is well known, having been long before the public. Underground mining is practiced here, and it would seem that the policy of the company has been too much to insist upon the importance of its rich ore rather than to face the larger elements of the problem presented in the utilization of masses of low-grade ore by the cyclopean methods that are now changing the character of copper mining in so many parts of the world. The Giroux undoubtedly has rich ore, but it seems unfortunate that no energetic effort is being made to open what may prove so large a mine that the high-grade masses will only be looked upon as something to sweeten the output. Many prospects are being worked, as always happens around every enterprise of magnitude. Despite their reputation, the Guggenheims have not taken everything in sight at Ely. Combinations of outlying properties may lead to the creation of important neighbors for the Nevada Consolidated and the Cumberland-Ely.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Forest Reserve and Mining.

The Editor:

Sir—The administration of the Forest Service, in so far as it relates to the miner and home-seeker, has been the subject of much adverse criticism: Mr. Gifford Pinchot, in his reply to an editorial in the Denver *Evening Post*, says: "The Forest Service has always invited candid criticism and co-operation of the people of the West in its attempt to give them a steadily more helpful administration of the National Forests, but it insists that criticism, to be helpful, must have some relation to the facts." Having made an examination of many of the claims in Plumas county, California, that have been contested by the Forest Service, I feel qualified to meet the conditions that the Forest Service imposes upon those who offer criticism.

Mr. Pinchot states in his reply that "the Forest Service has never denied a patent to any mineral claim in any National Forest, nor declared the same invalid, for it has no right to do so. But it is the duty of the Forest Service under the law to report to the Department of the Interior, upon its request, the actual facts on the ground concerning any claim or location within a National Forest, to enable the Department of the Interior to form a judgment as to the validity of such claim or location. The Department of the Interior forms that judgment and acts upon it—the Forest Service merely reports such facts as it finds. It is not the judge, but merely a witness in the case." This is merely an attempt to shift the responsibility. The Forest Service has been most active in its efforts to exclude the miner and home-seeker from the Reserve. The Forest Service seems to consider that its principal duty is to depopulate the country in favor of timber-culture.

Before the creation of the National Forests the prospector in California was free to locate and record mining claims; to prospect and develop them in his own way, and at a time best suited to his interests; and he remained in possession as long as the requisite amount of assessment work was performed each year. This was the law. Many a farmer has occupied his idle winter months in 'drifting' for a back channel that might require years of his work to reach, his only justification for the work being his *faith* in the existence of such a channel.

The Use Book of the Forest Service expressly states that the miner and home-seeker shall be accorded the privileges they formerly enjoyed before the creation of the National Forests. But there is an unwritten law: that the prospector must be able to prove the mineral character of the ground he has located *at any time* the Forest superviser or his rangers see fit to question the validity of his location. It is not sufficient that the ground shows encouraging prospects, or that there is every indication of an ancient channel; it must be shown to be profitable mining ground, "more valuable for the mineral than the timber." This virtually means a cessation of all prospecting within the Forest Reserve. No miner cares to risk either time or money in prospecting a claim when the right to continue the work may be denied him at any moment.

The methods employed by these Government experts in determining the character of the land are interesting: In one instance a pit was dug to the depth of five feet; a surface inspection sufficed in all other cases. It is true that where bedrock is exposed on steep hillsides and ridges, the character of the land may be determined by a superficial examination, but can it be foretold what lies beneath the surface of the soil, gravel-bank, or lava-cap, without recourse to shafts, drifts, or bore-holes? Yet the prospecting work of these experts who declared the contested Yard claims to be non-mineral, was limited to a few pans taken from the surface.

While the miner is merely denied the right to prospect and hold claims within the Forest Reserve upon the testimony of the Government officers, the home-seeker is subject to arrest and imprisonment. I refer particularly to the contested case of William H. Beatty. The property known as the Beatty homestead, situated in Butterfly valley, six miles from Quincy, Plumas county, California, was filed upon as a homestead by John Brinker in 1887. The improvements were bought by William Maxwell in 1892, who afterward sold them to Beatty, and thereafter the place was continuously occupied by him and his family until after application was made for patent, which application was granted in March, 1905. Beatty remained in undisturbed possession of the property, and it was finally sold by him, no patent yet received.

Last winter Beatty was placed under arrest by a United States marshal and, refusing to give bail, he was transported to Alameda county and placed in the Oakland jail, and there confined for a considerable time, until bail was furnished by residents of Quincy. His arrest and subsequent indictment on the charge of perjury in having sworn falsely to a homestead affidavit was brought about by the testimony of Edward Doyle, Frank H. Smith, G. A. Hall, and LeRoy A. Moore. The charging part of the indictment reads as follows: "As he, the said William T. Beatty, thus and there well knew, the said land was then and there mineral in character, and as he, the said William T. Beatty, then and there well knew had been successfully mined for gold, and that large quantities of gold had been taken out of said land; and whereas, in truth and in fact the said William T. Beatty then and there well knew that a large portion of the said land had been heretofore and was then and there worked for mineral and that the said land was then and there essentially mineral instead of non-mineral, whereby he, the said William T. Beatty, did then and there commit wilful perjury."

From a personal examination of the property, I can state that the contested portion of the homestead is not profitable mining ground; that the land was

thoroughly prospected and abandoned years ago, until Frank Smith, now a Forest ranger, and his brothers resumed operations some three years ago, long after Beatty had made his homested entry; that the amount of material washed by them did not exceed 2700 cu. yd., and that it could not have yielded over 40 cents to the man per day; that they have for some time suspended operations, and removed their sluice-boxes from the property.

The remaining ground within the confines of the property available for mining purposes is less than one acre. Any person would have been justified in considering the land more valuable as a homestead than for its mineral content.

Beatty is highly respected; he has the sympathy of the entire community against the Forest Service in his struggle for justice.

There is a general feeling of dissatisfaction among the residents of Plumas county in the present administration of the Forest Service.

DOUGLAS WATERMAN.

San Francisco, December 19.

Flotation-Process Litigation.

The Editor:

Sir—As your London correspondent I have, from time to time, referred to litigation in the English courts between the owners of the Elmore and Ballot-Sulman-Picard patents, for concentrating ores by means of oil. The decision given in the Court of Appeals on December 2 bids fair to end this long dispute, and to place the control of the oil-flotation process in the hands of the Elmores. The judgment reversed the decision of the Court below given by Mr. Justice Neville five months ago. The Court of Appeal consists of three judges, one of whom in this case was Lord Justice Fletcher Moulton. This judge is prominent as a lawyer with a special training in science. He was senior wrangler at Cambridge, and has always been noted for his grasp of technical details. He prepared the judgment of the Court, in which his colleagues joined unanimously. The decision was not rendered hastily; two weeks were taken for preparation and consideration. The defendants may appeal to the House of Lords for final argument, though that court is not likely to differ in opinion from an eminent judge thoroughly familiar with his subject. An interesting point in connection with this trial is that Fletcher Moulton, before becoming judge, advised in his capacity as attorney on the original Elmore specification. When he found this case on his list of trials he notified both parties that this fact would prevent him from sitting in judgment. Both parties, however, assured him of their confidence in his fairness and freedom from bias; in fact, they both specially desired the case to go before him on account of his familiarity with the subject in hand. The point was a small one, for he had given his professional opinion on the original Elmore specification before the existence of that taken out by Ballot, Sulman, and Picard.

The question in dispute was whether the Minerals Separation Limited, operating the Ballot-Sulman-Picard patent, were infringing the Elmore patents of 1898 and 1901. These describe the old oil-flotation process, which has since given way to the improved form known as the vacuum process. The 1898 patent claimed "separating the metallic from the rocky constituents of ore by mixing the pulverized ore first with water in considerable quantity, then adding to the mixture an oil, consisting of a thick tarry residue of mineral oil after some of the volatile constituents have been driven off, the said oil adhering to the metallic constituents but not to the rocky constituents, allowing the water carrying the rocky material to subside while the oil carrying the metallic constituents floats above." The specification of the 1901 patent claims the "addition of a small proportion of acid to the mixture of ore, water, and oil, such slight acidulation greatly enhancing the selective action of the oil." In the Ballot-Sulman-Picard patent of 1905 reference is made to small quantities of light oil and acid, which are energetically beaten into contact with the mixture of ore and water so as to produce an aeration of the mixture. The patentees argued that of the three known physical reasons why oiled metallic particles are enabled to float, they depended solely on surface tension and aeration, while the Elmore patents of 1898 and 1901 relied solely on the third, namely, the specific gravity of the mixture of ore and attached oil. Lord Justice Fletcher Moulton quoted on this point the maxim that an inventor did not have to explain the scientific principle on which his process acts, and he also urged that at best our knowledge of the rationale of the flotation processes is incomplete, so that he was unable to base a judgment on this conception of principles utilized in the various inventions. He found that the 1898 invention was the valid one, but that, as the patentee expressly mentions a thick oil, the defendants' patent of 1905 did not infringe it, seeing that they specially claim a thin oil. On the other hand, he held that the use of small quantities of acid in assisting the selective action of the oil was undoubtedly first disclosed in the Elmore 1901 patent, and therefore the Ballot-Sulman-Picard patent of 1905 infringed it as far as the use of acid in conjunction with oil is concerned. The result of this judgment is that the Elmores may claim priority in all processes where oil and acid are used. After this decision it would seem to be reasonable to effect a consolidation of interests at stake. The Elmores are blocked by Ballot, Sulman, and Picard in the use of thin oils; on the other hand the Ballot-Sulman-Picard patent is practically stripped of its value by the ruling as to the use of acid. The concentration processes using oil and acid are thus brought under the master patent of 1901. From a broadly economic standpoint it is well that the oil-flotation process is now freed from the embargo of legal disputes. Metallurgists may now develop the practical possibilities of the method without fear of disastrous lawsuits. It is noteworthy that no mention is made of the buoying action of gas-bubbles generated by the acid, but this was not the matter in dispute, although it is a phenomenon that plays an important part in all modern flotation processes.

EDWARD WALKER.

December 10, 1908.

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BUCYRUS PLACER GOLD DREDGE, "THREE FRIENDS No. 1."

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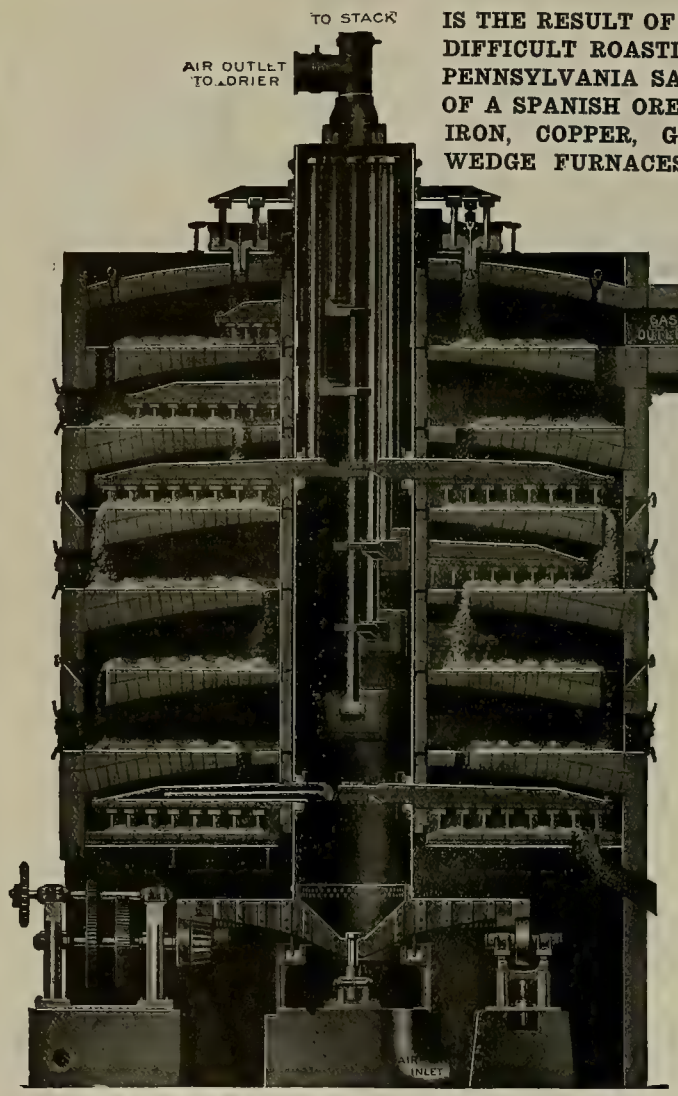
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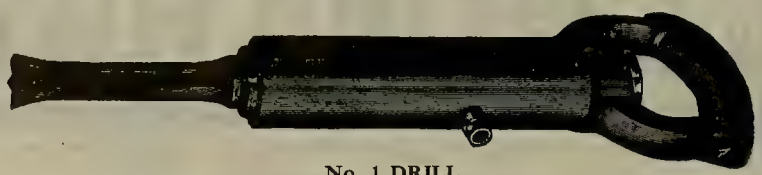
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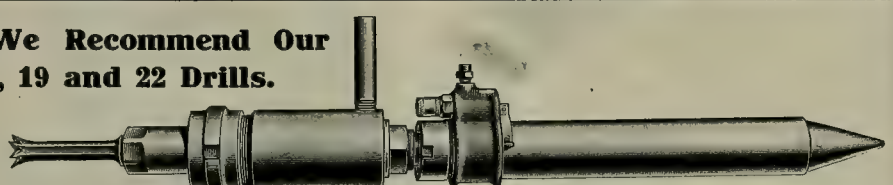
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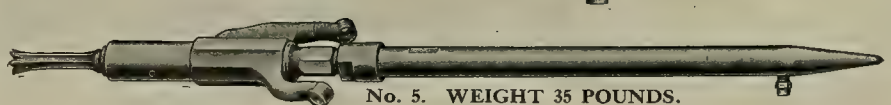
Every Wonder Drill is Fully Guaranteed to Do Satisfactory Work.

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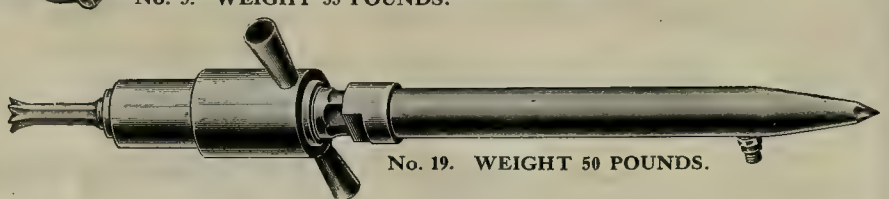
For Stoping We Recommend Our Numbers 5, 19 and 22 Drills.



No. 22. WEIGHT 65 POUNDS.



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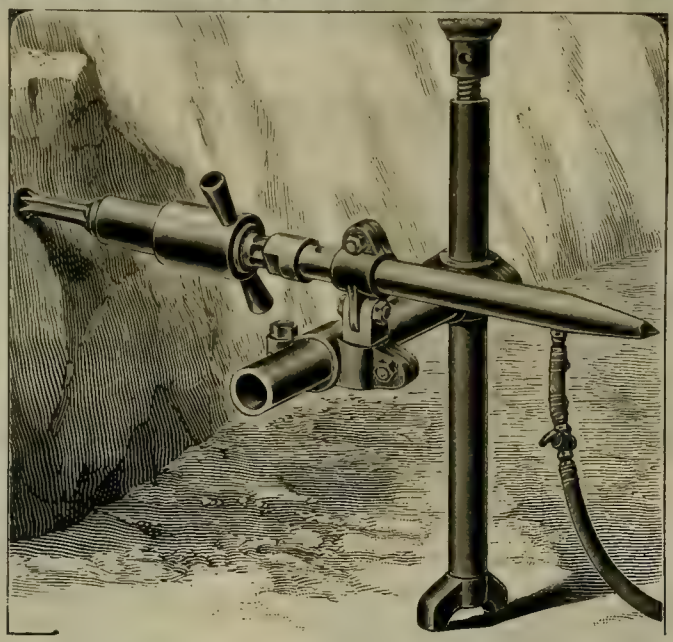
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No. 5 is a light machine, weighing 35 lbs. No. 19 is a heavier machine—weight 50 lbs.

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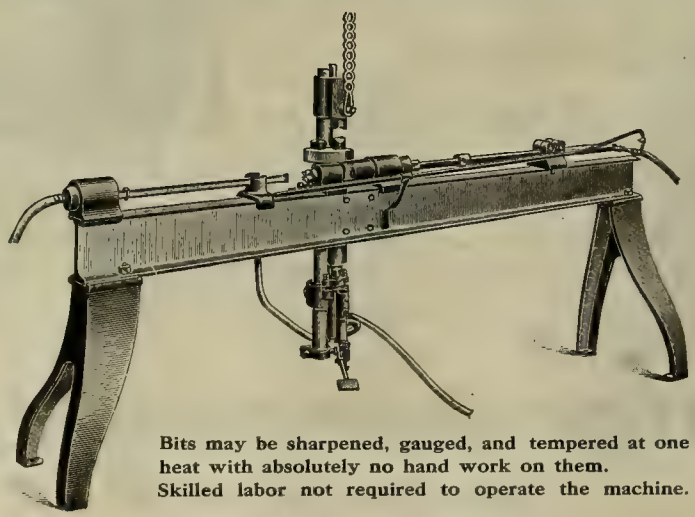
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Bits may be sharpened, gauged, and tempered at one heat with absolutely no hand work on them.
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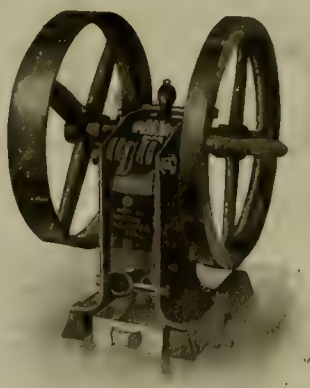
LABORATORY LABOR SAVERS

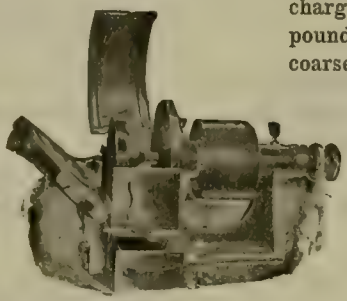


DISC PULVERIZER.

Braun's Chipmunk Crusher

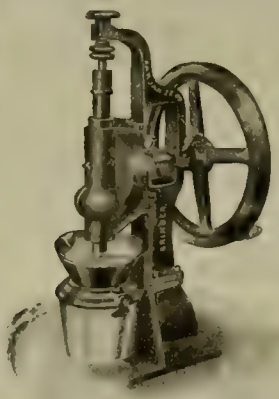
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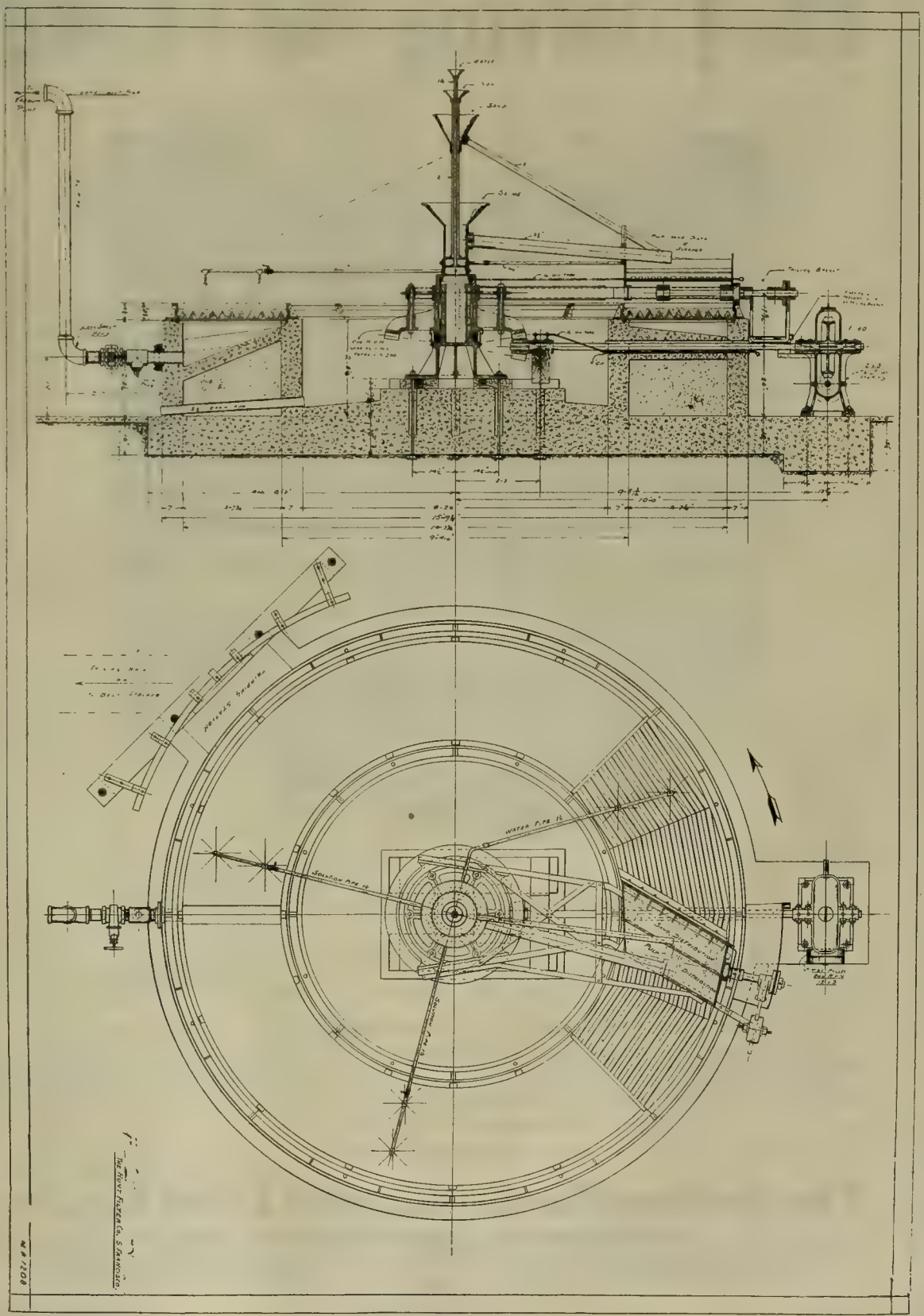
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Mechanical Engineers:

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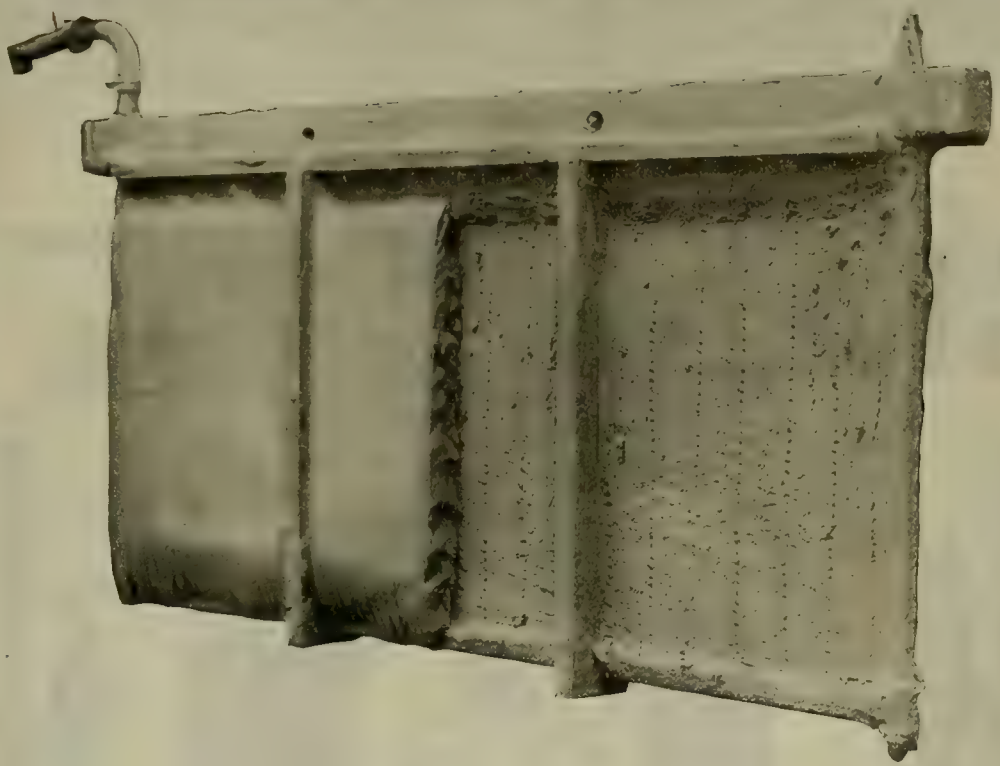
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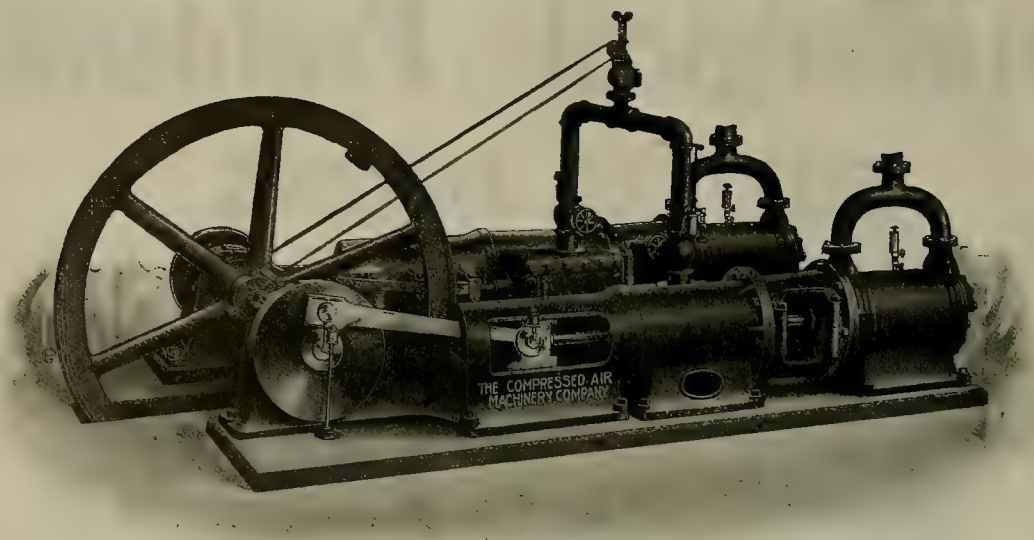
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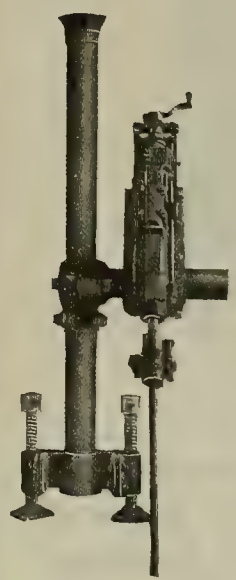
Telegraph "*MACHINERY*," San Francisco, for



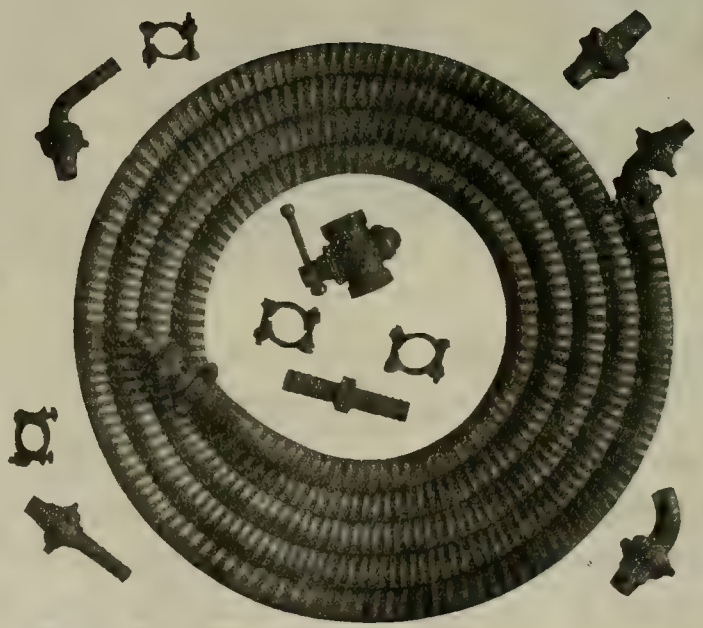
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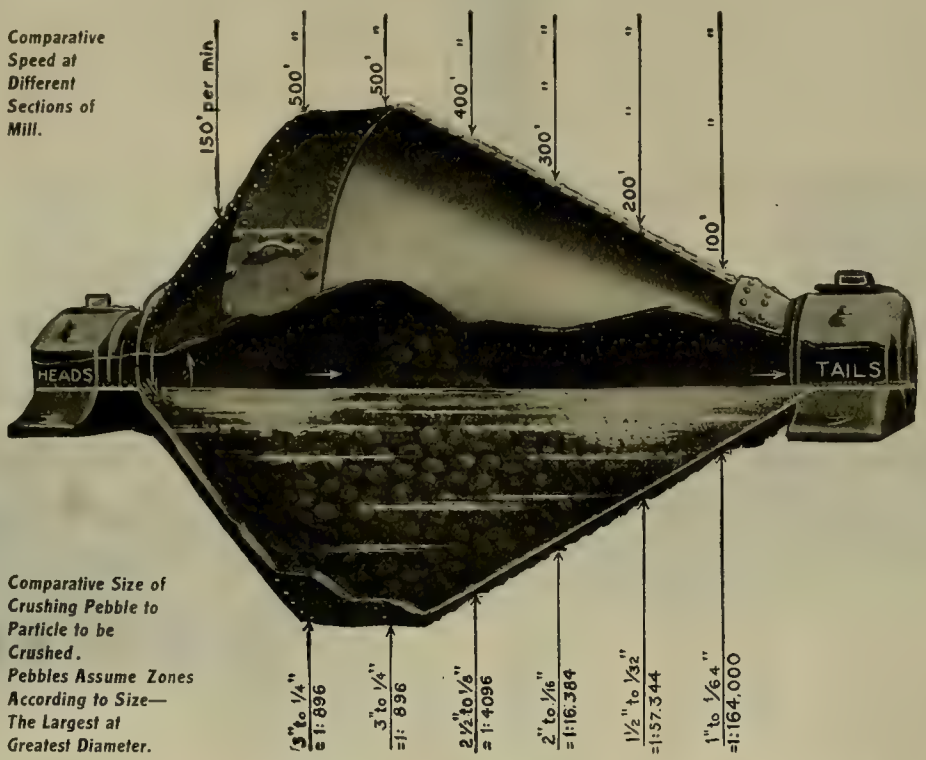
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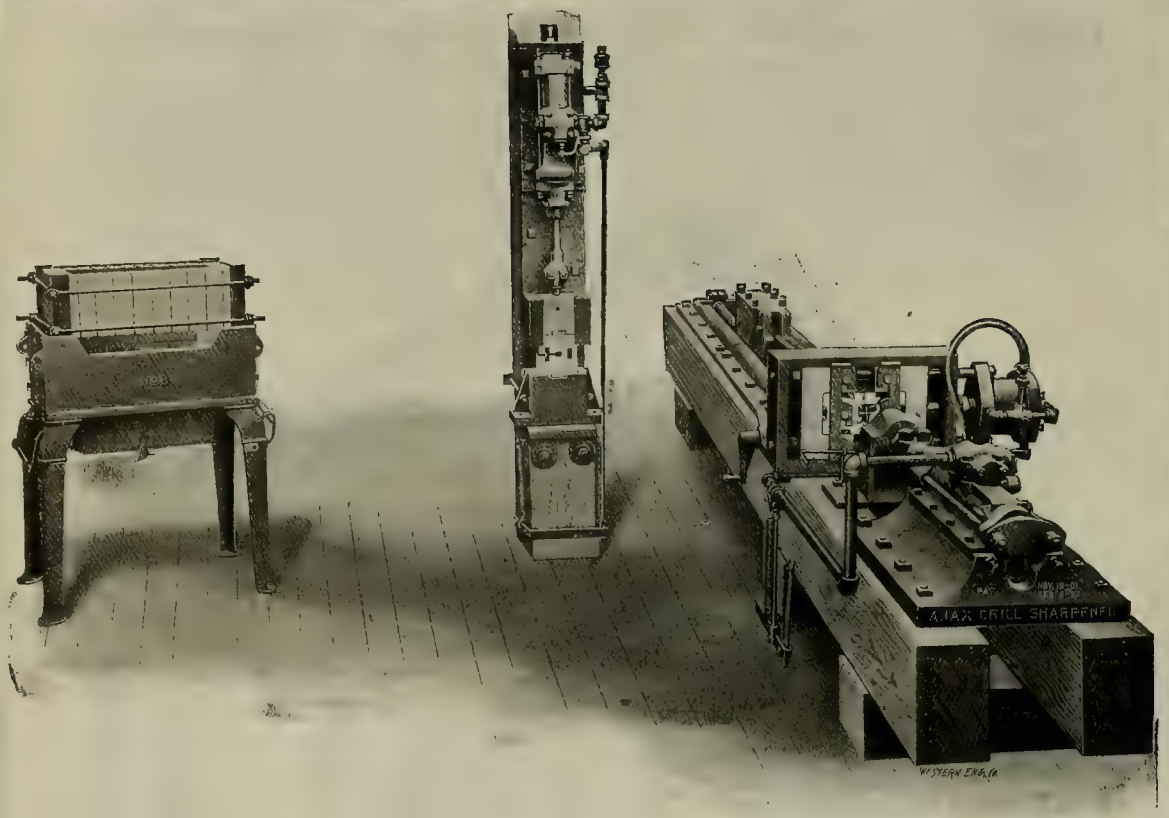
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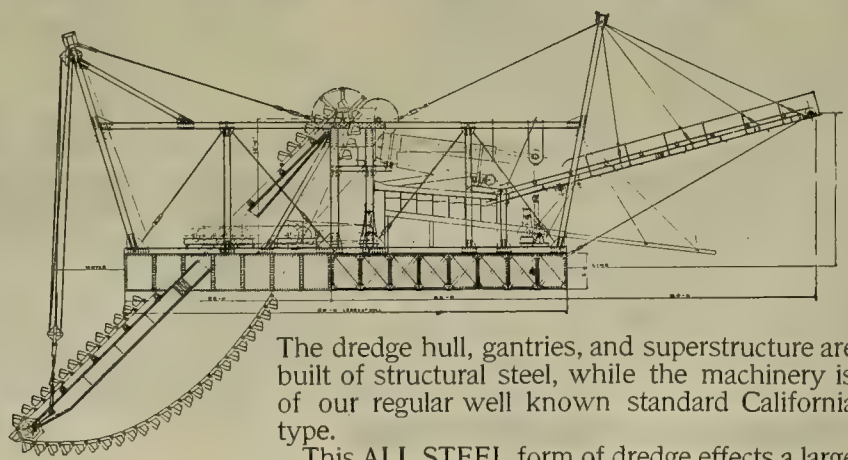
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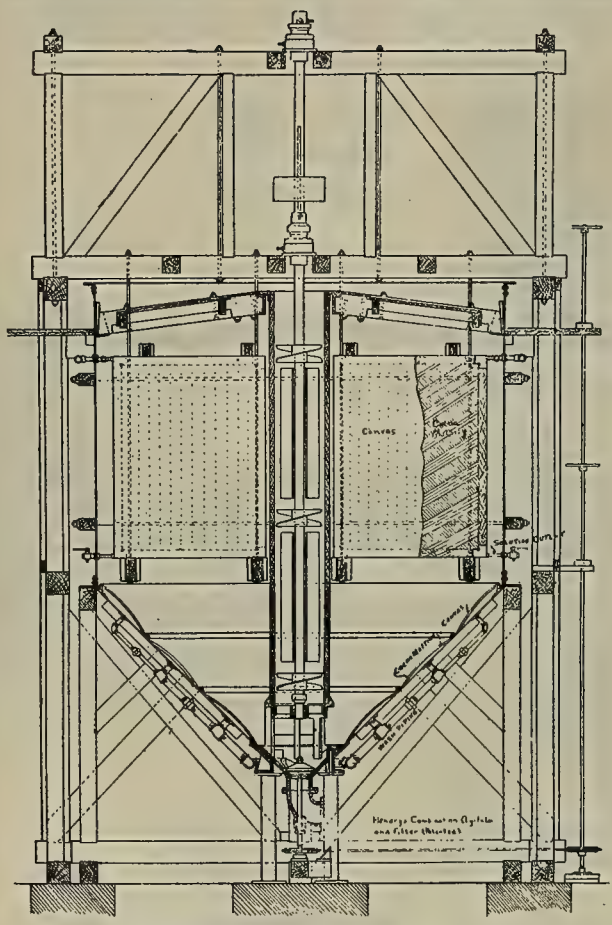
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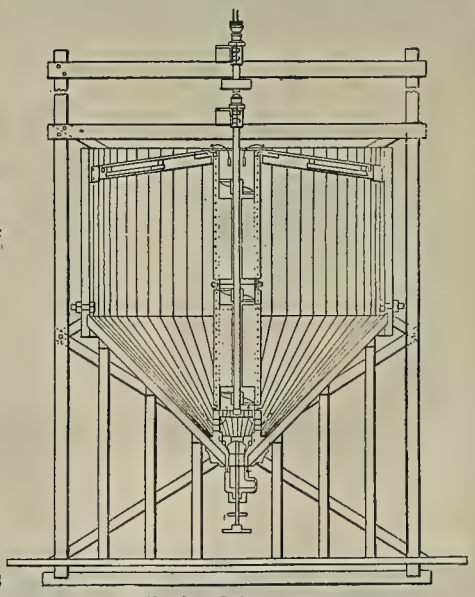
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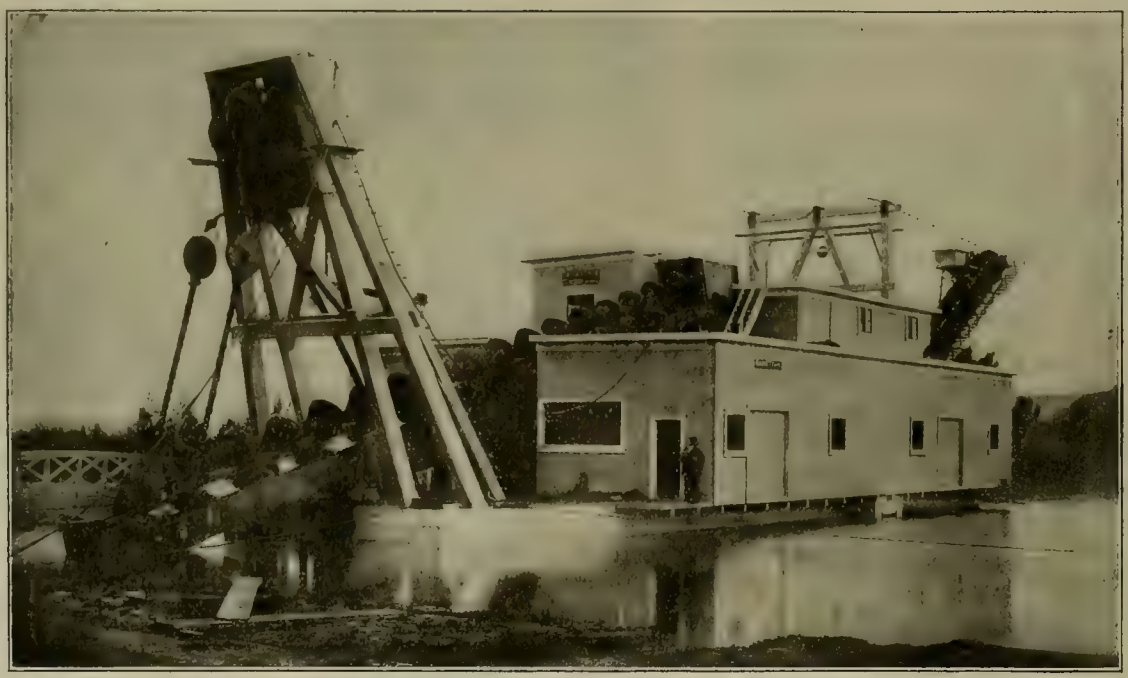
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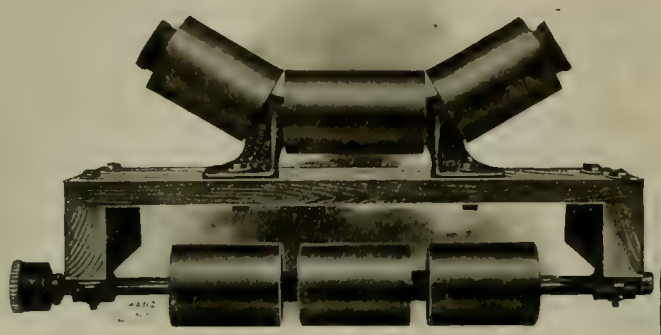
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(CONTINUED ON PAGE 26.)

GOLD DREDGING

IS A METALLURGICAL AND MECHANICAL PROBLEM

SUCCESS

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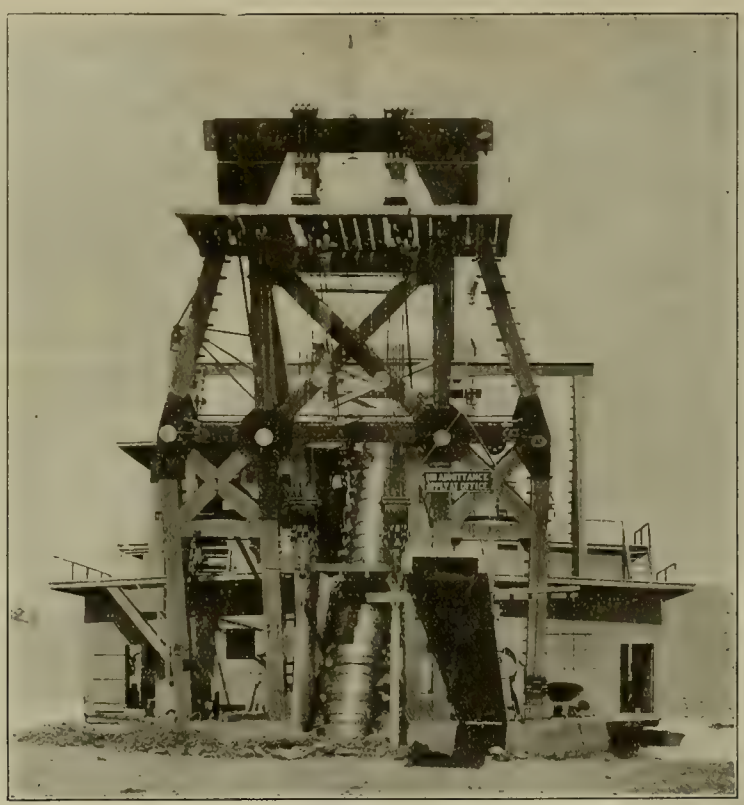
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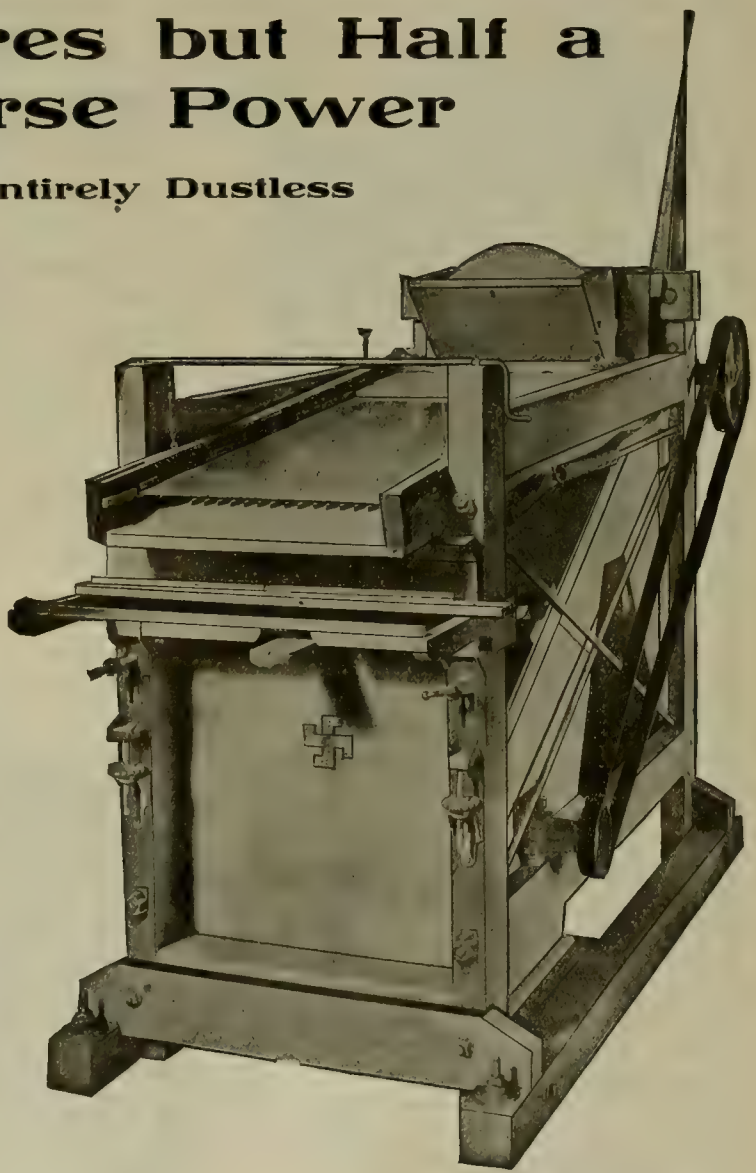
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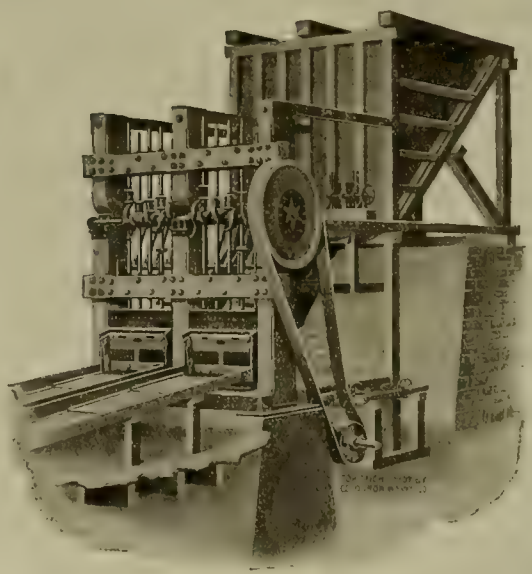
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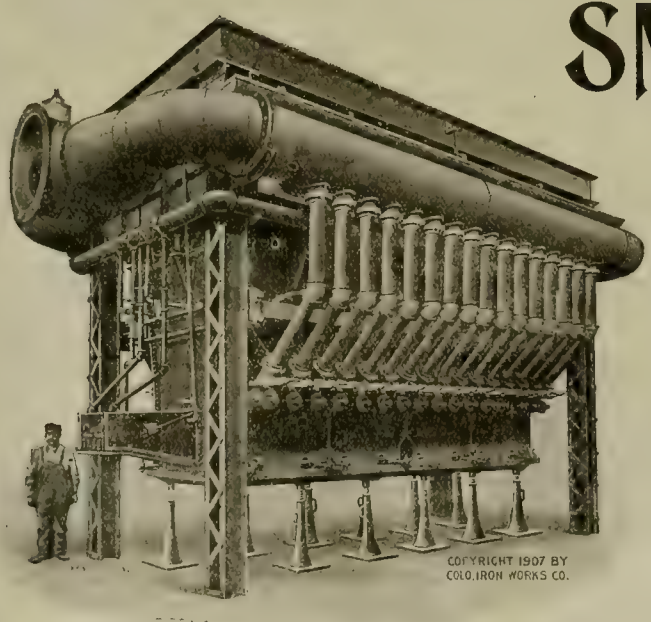
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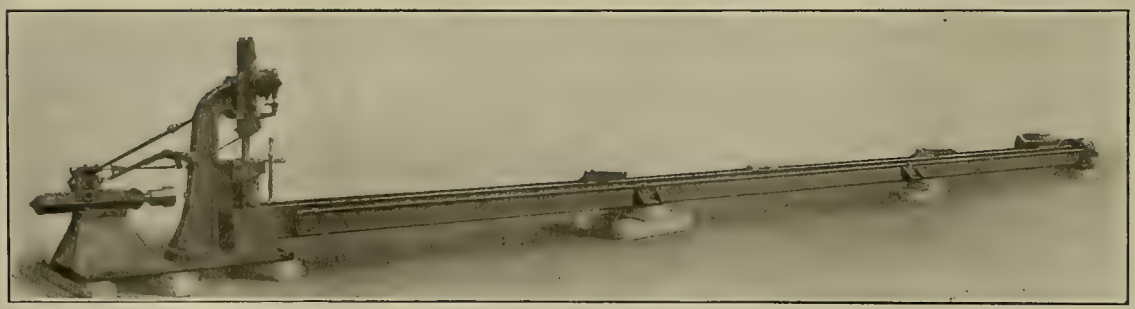
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LANG, H. H.,
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MERCER, JOHN W.,
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MERRILL, FREDERICK J. H.,
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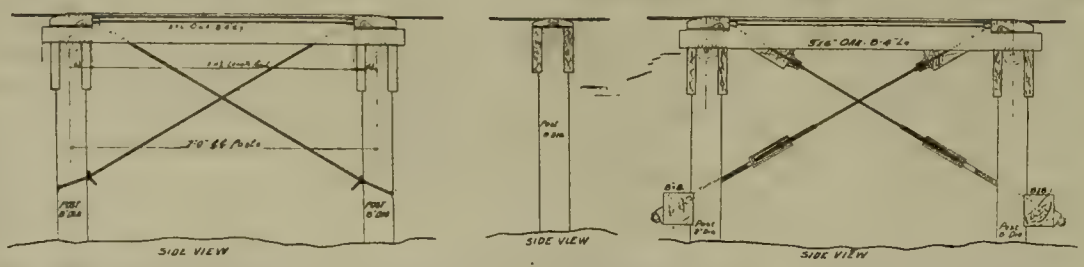
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Durango, Mexico.

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PRICHARD, W. A.,
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RAYMOND, ROSSITER W.,
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(CONTINUED ON PAGE 36.)

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ADVANTAGES:

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SAVING of large installation cost for Concentrating Plant.
SAVING conveyors and transit of ores to Roasters.
SAVING of coal and coal storage, hoppers, and labor attendant on all above operations.
SAVING of raw dust losses consequent to drying and dry crushing preliminary to roasting.
SAVING of values due to volatilization, as also values converted into coarse gold during roasting —no poisonous fumes being a wet crushing method, the whole process is sanitary.
SAVING time compared with simple cyanide processes, inasmuch as the whole operation of extraction and recovery of the precious metals is completed within twelve hours.
SAVING of tankage and floor space, buildings, etc.
COMPLETE dissolution of the precious metals contained in even the most refractory sulphide and telluride ores.
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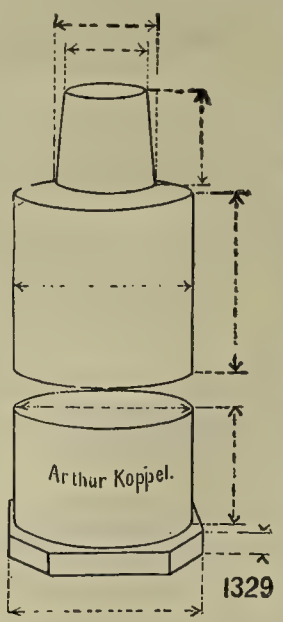
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THOMPSON & GILLIAM,
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TURNER, H. W.,
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208 McPhee Bdg., Denver, Colo.
Choix, Sinaloa, Mexico.
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WEATHERBE, D'ARCY,
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Rio Tinto Co., Spain.
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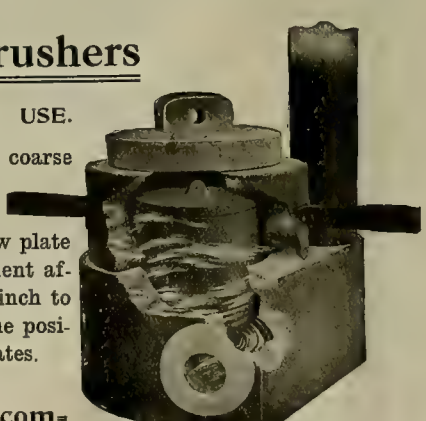
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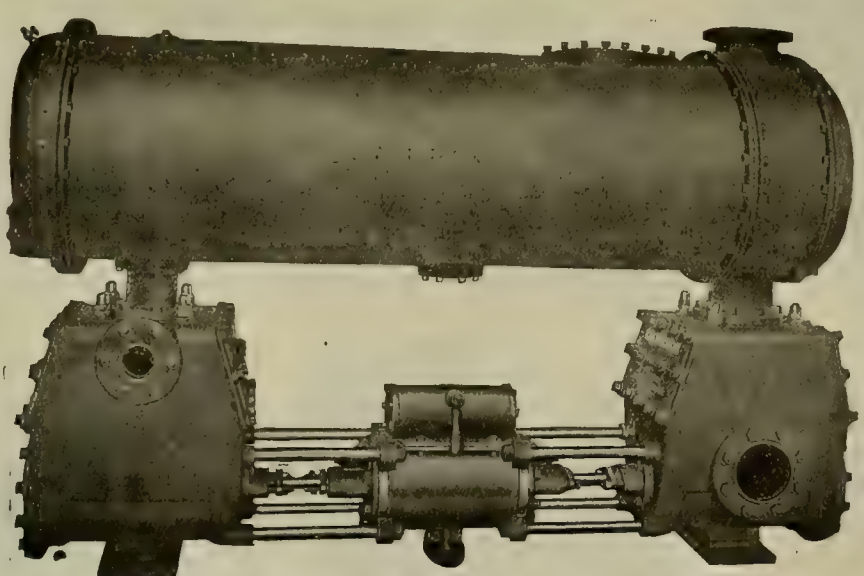
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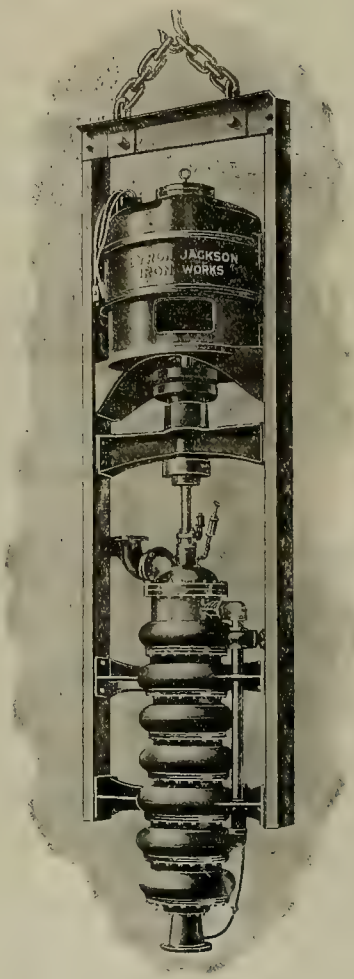
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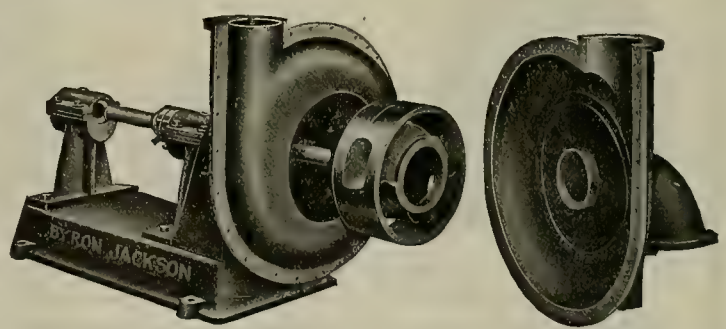
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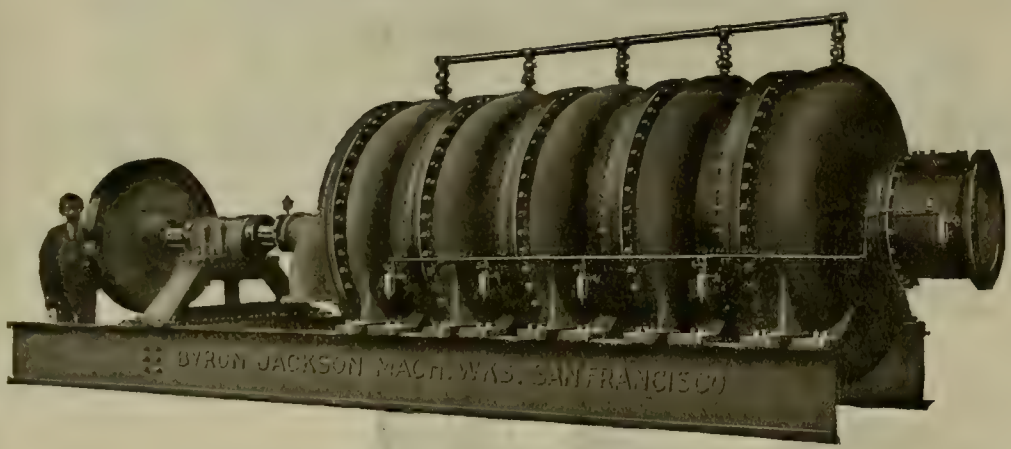
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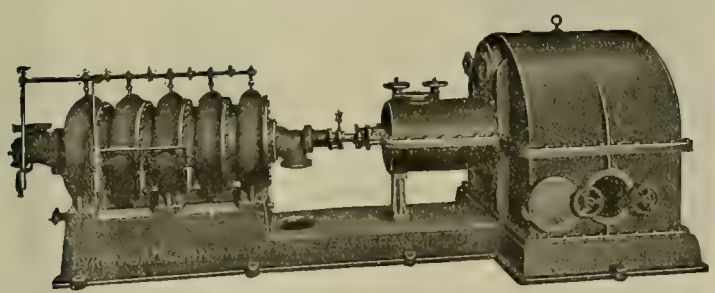


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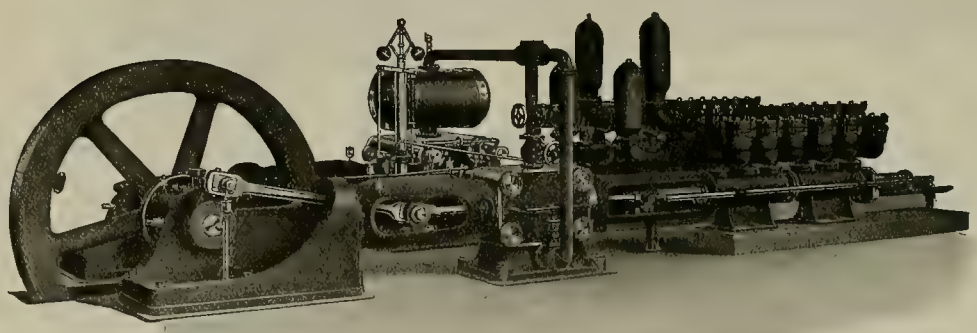
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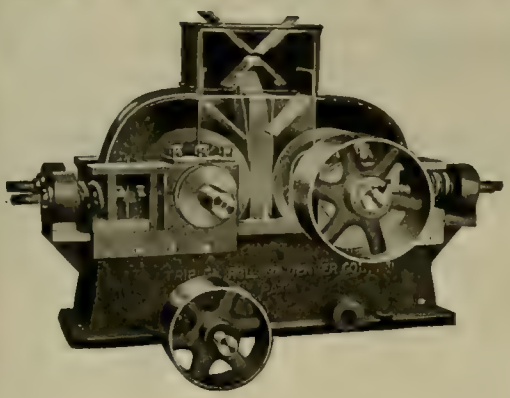
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Holland, Belgium	1	3	16	9	'5	34
England	...	...	9	24	50	83
Spain, Switzerland, Scandinavia	...	1	2	11	5	19
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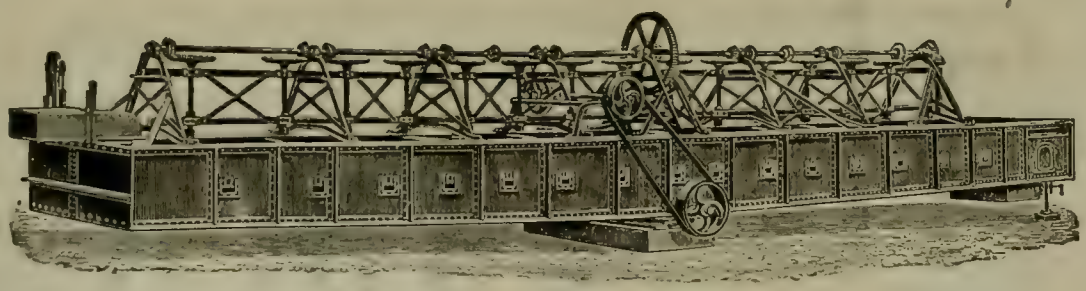
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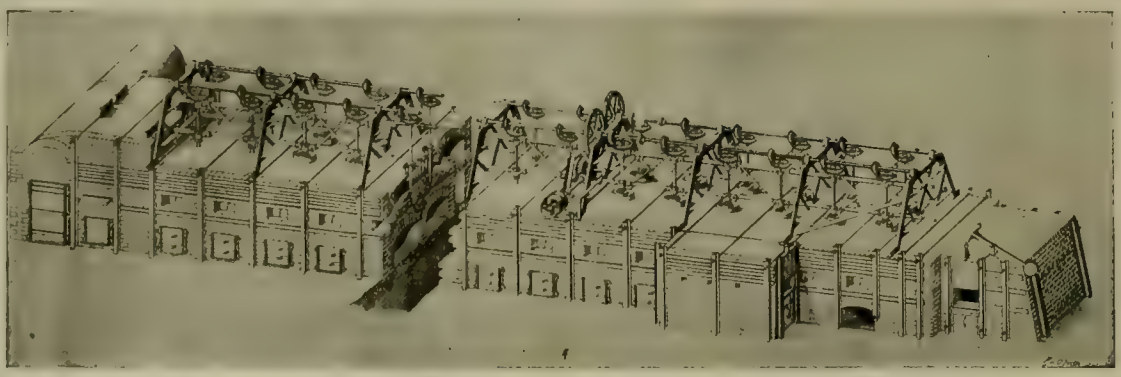
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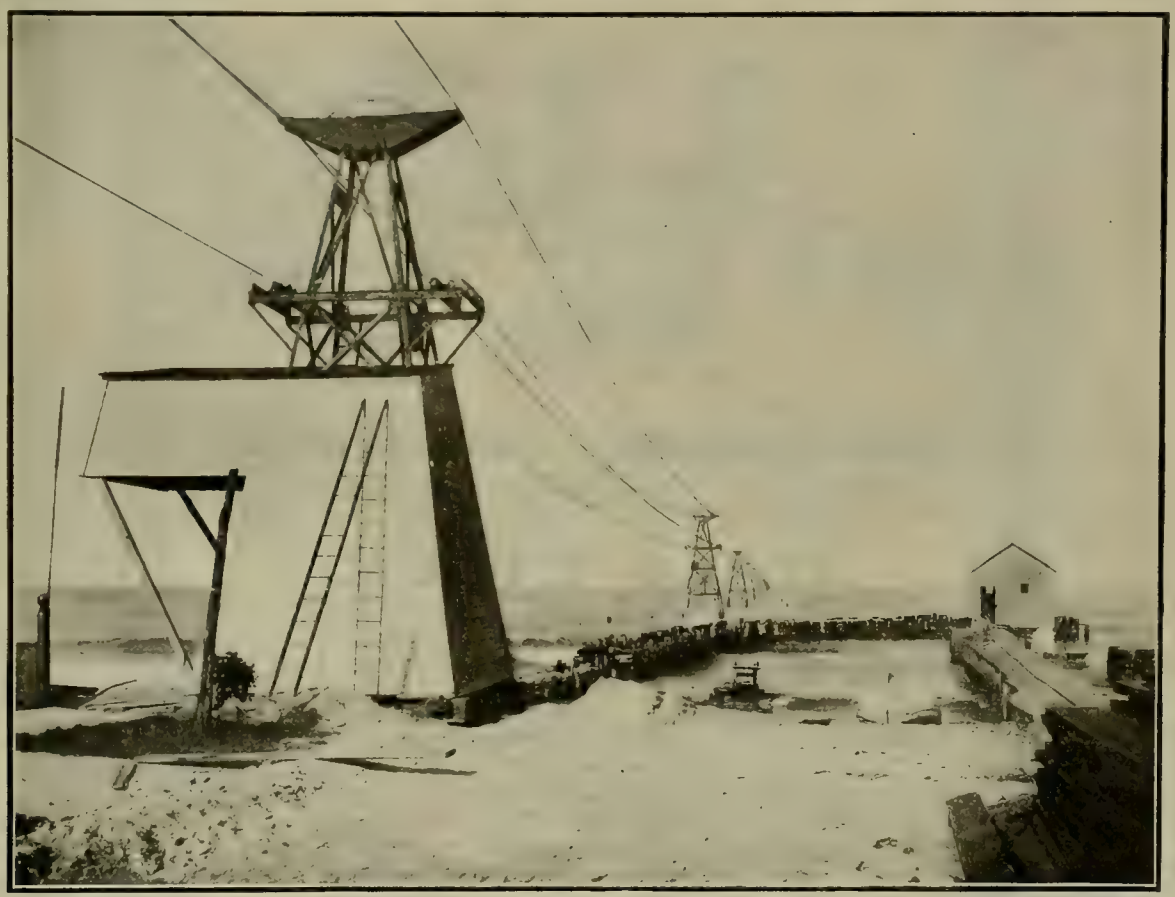
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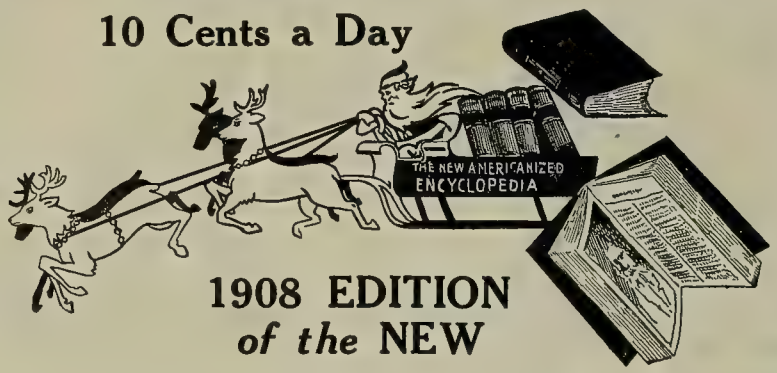
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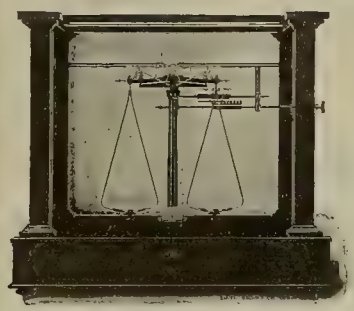
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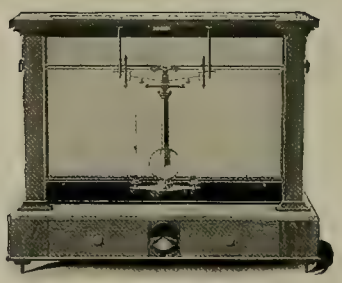
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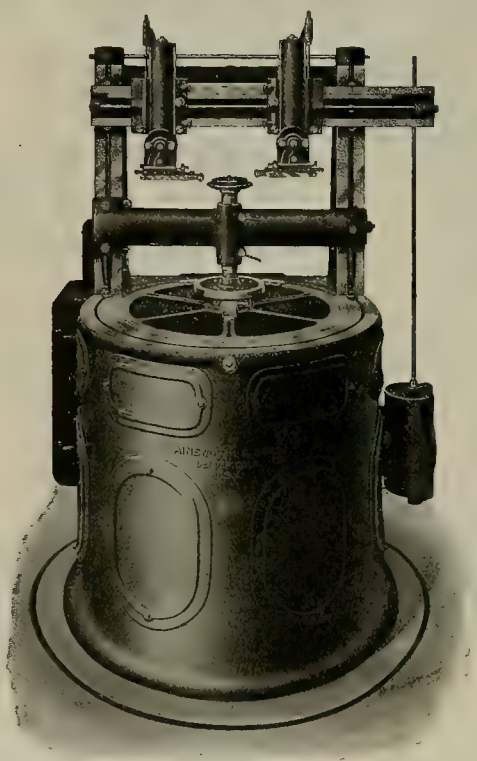
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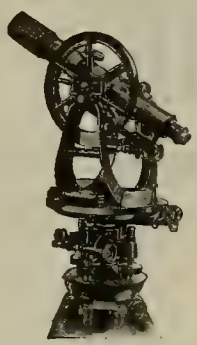


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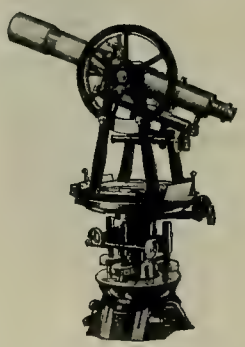
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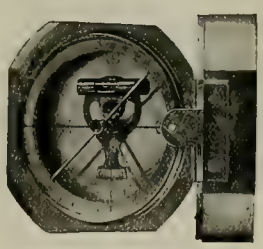
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"American" Centrifugal Turbines are described in Bulletin No. 108.

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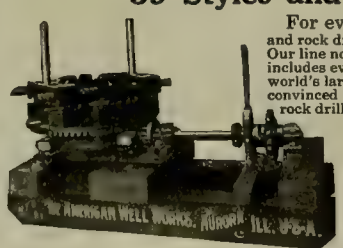
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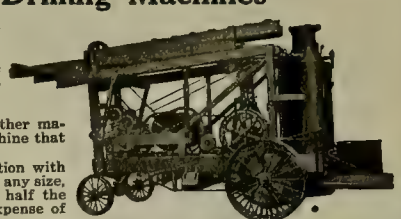
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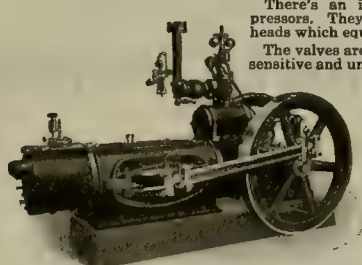
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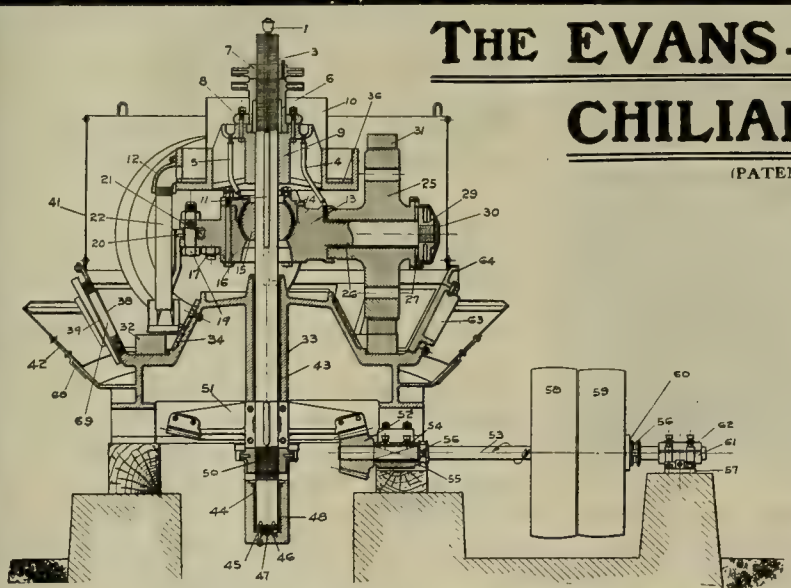
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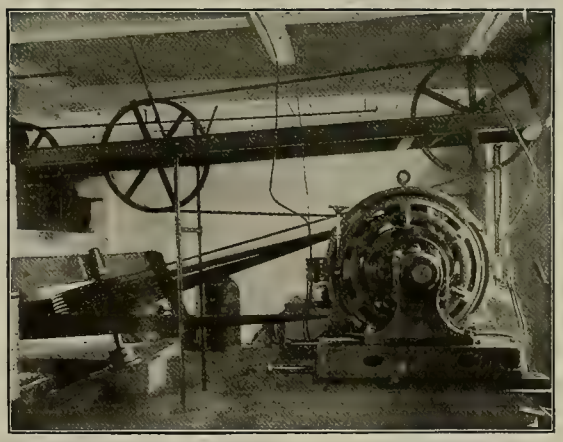
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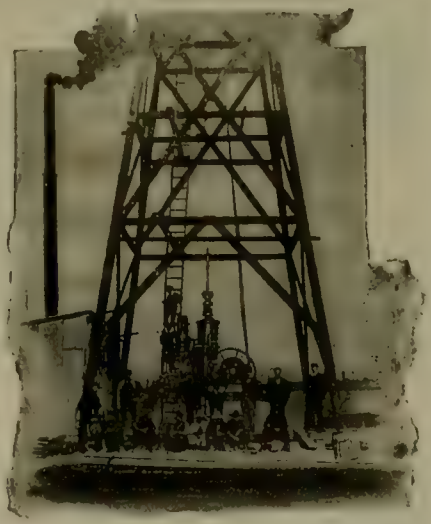
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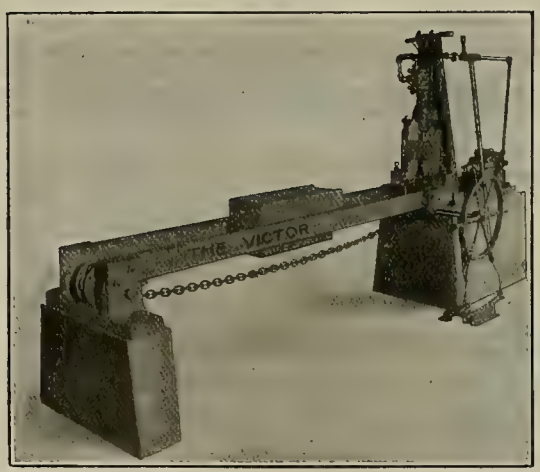
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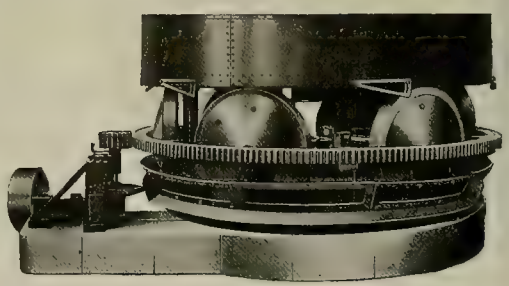
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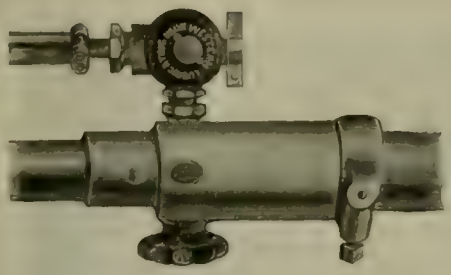
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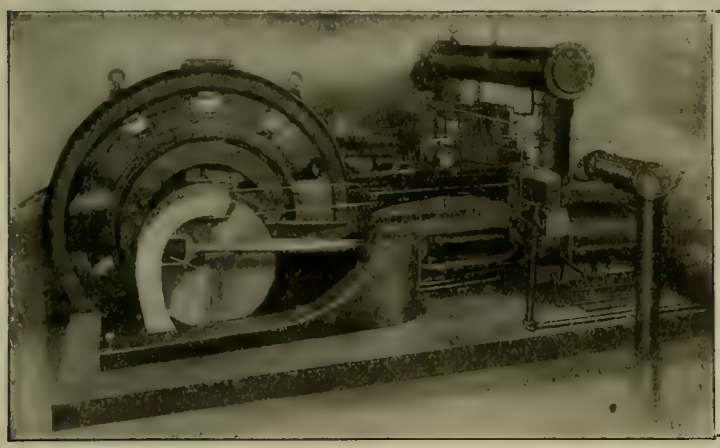
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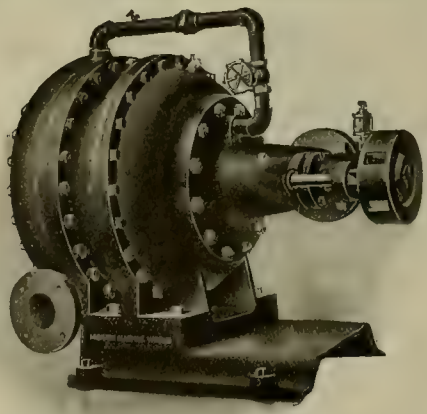
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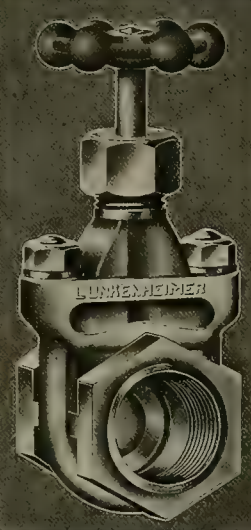
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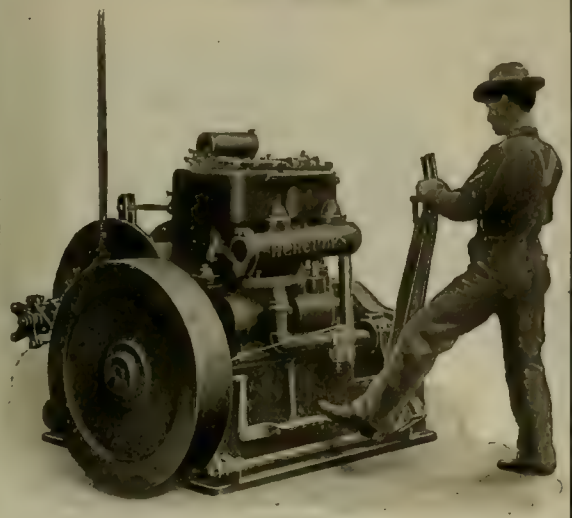
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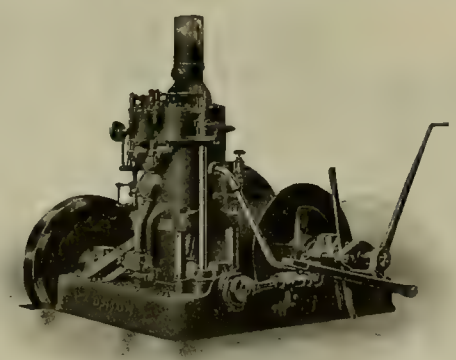
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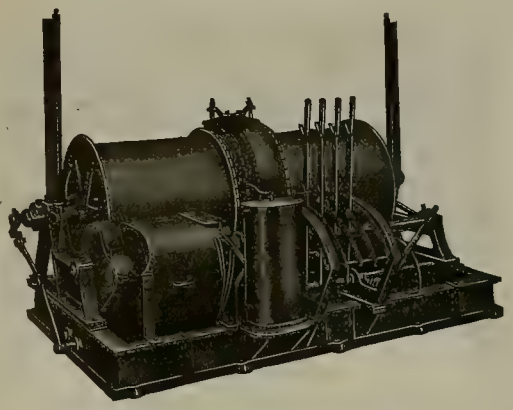
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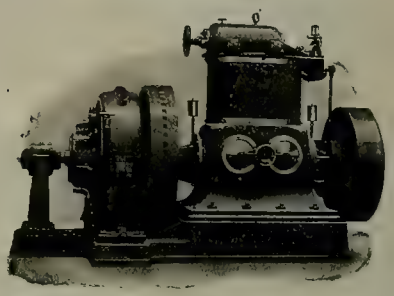
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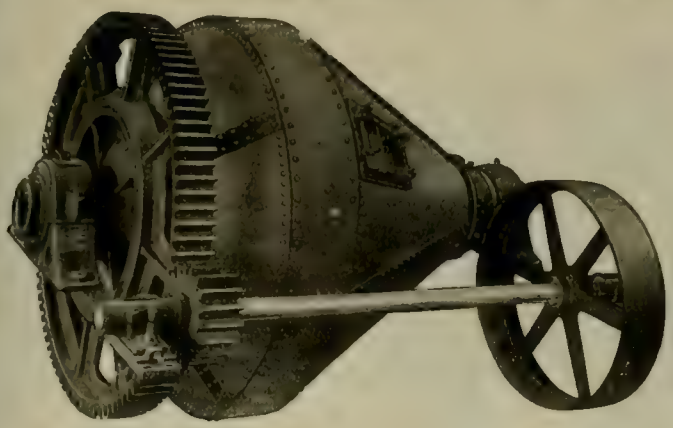
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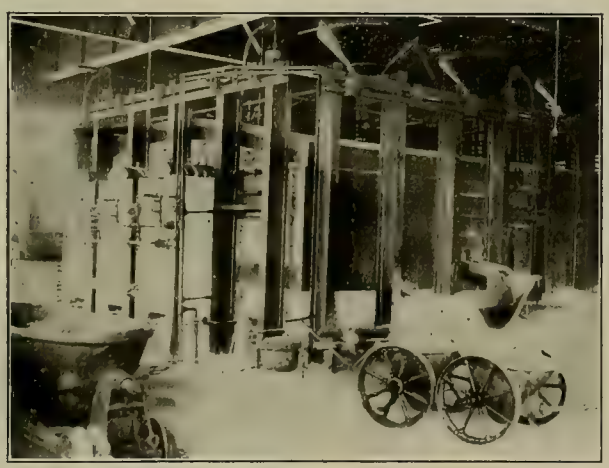
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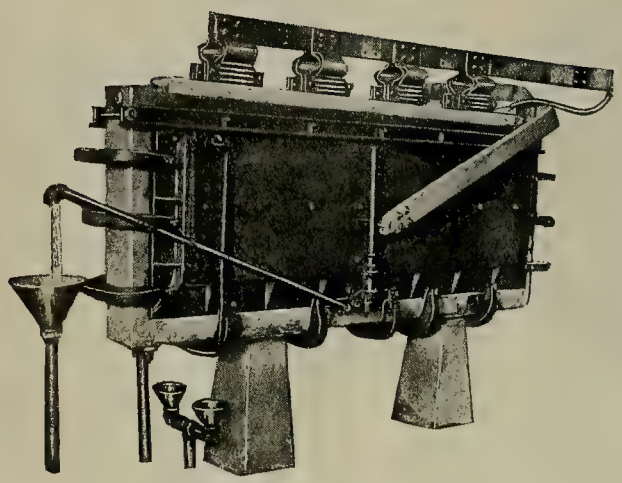
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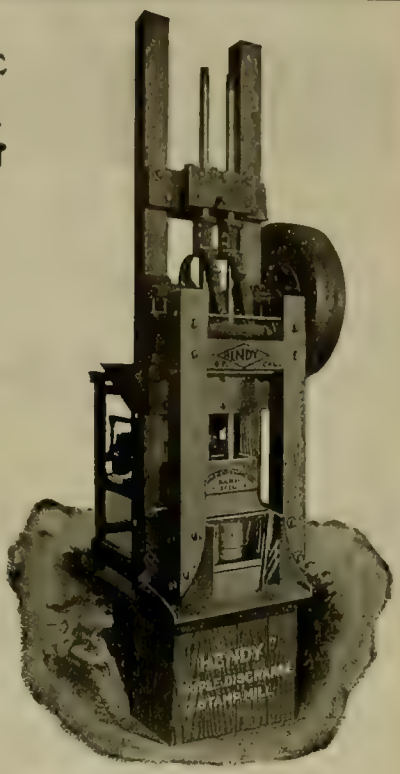
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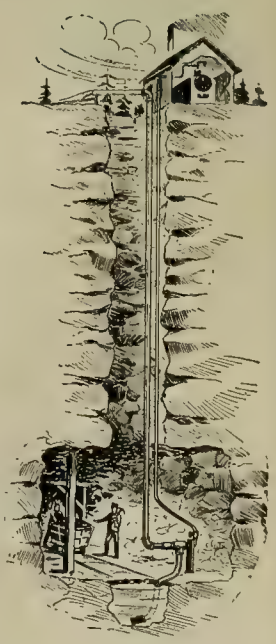
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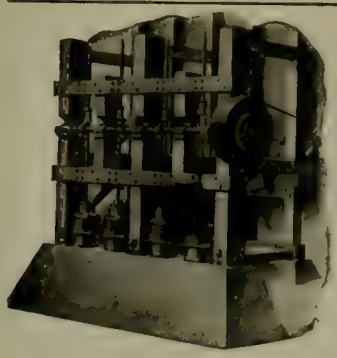
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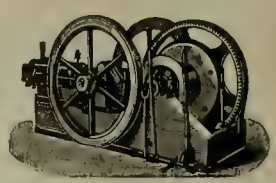
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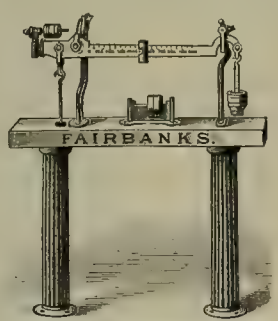
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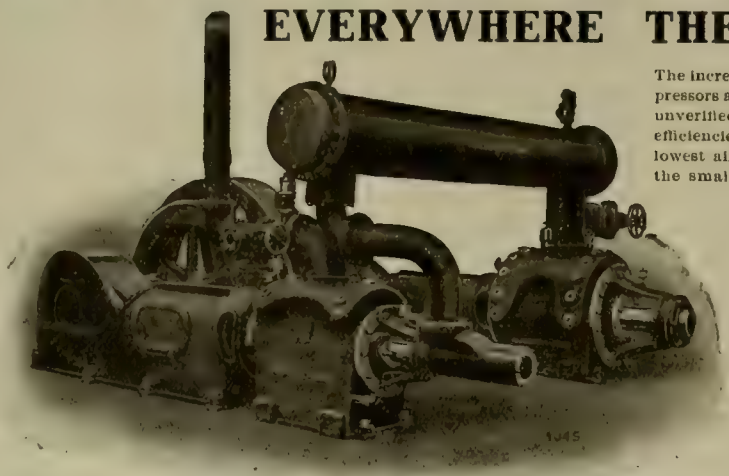
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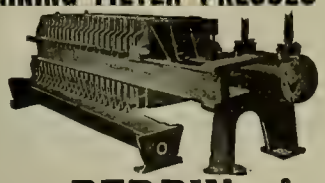
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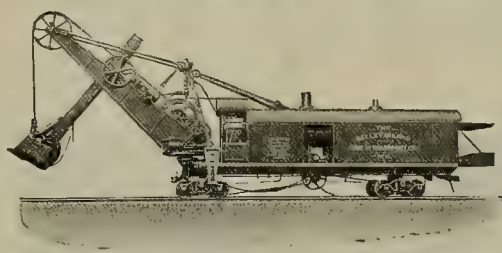


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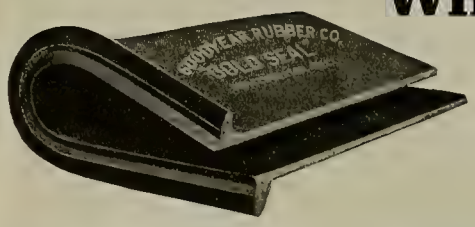


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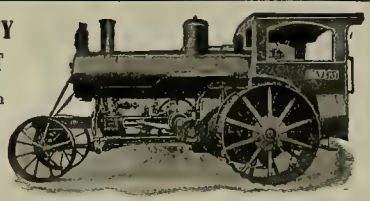
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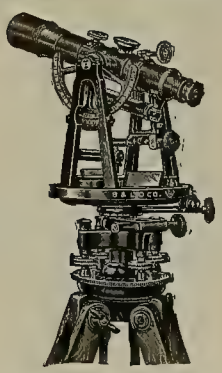
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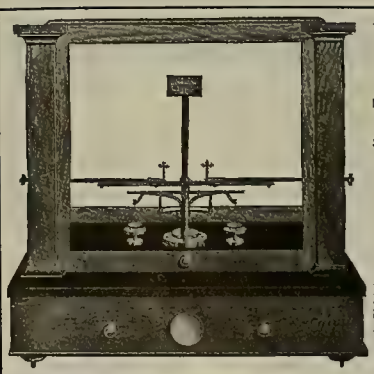
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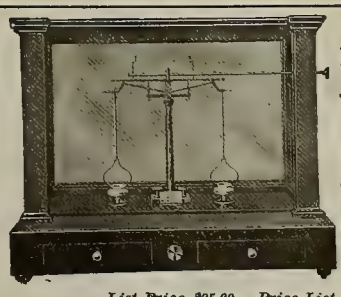
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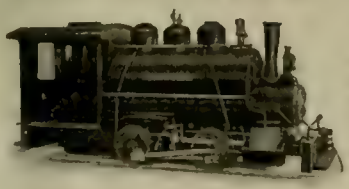
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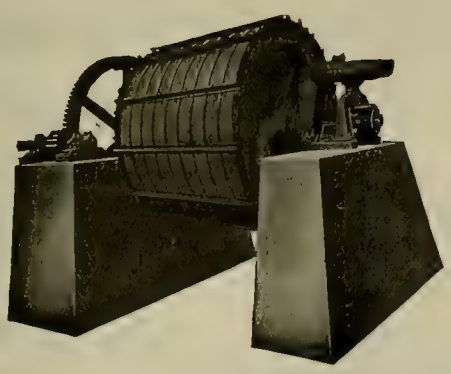
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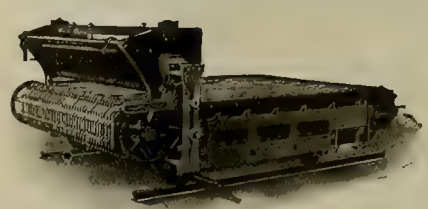


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1 set Davis Sampling Rolls.
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10 950-lb. Single Discharge Mortars.
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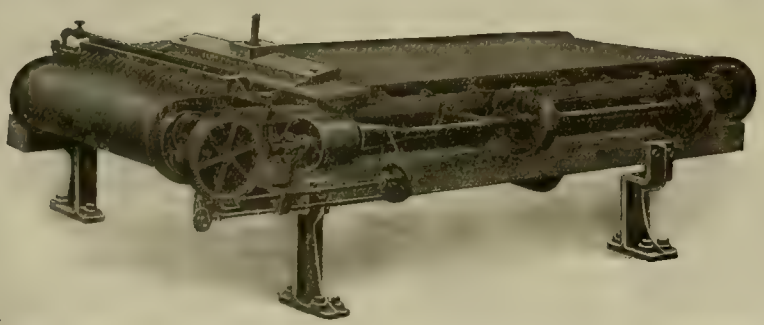
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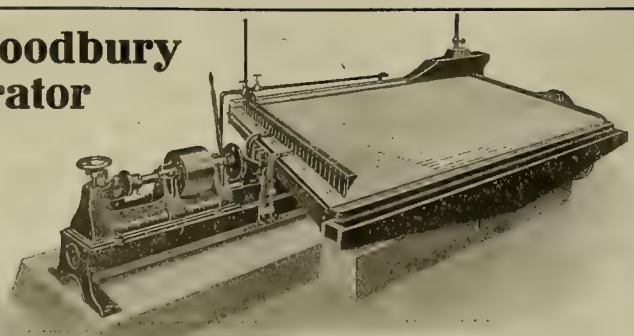
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NOTICES OF RECENT PATENTS.

Among the patents recently obtained through Dewey, Strong & Co.'s Scientific Press United States and Foreign Patent Agency, the following are worthy of special mention:

GAS REGULATOR.—No. 906,810; December 15, 1908. O. W. Lutz, Petaluma, Cal. This invention relates to gas and heat regulators and controllers, and pertains especially to a thermostatic arrangement for regulating the heat for incubators and the like. It provides a practical gas controller for machines of any kind, and can be shipped and set up as a single bit of mechanism by an ordinary operator.

PIPE HANGER.—No. 906,806; December 15, 1908. J. C. Kortick and G. C. Eberhard, San Francisco, Cal. This invention is designed to produce a clamp composed of two semi-circular segments, with a novel means by which these segments may be flexibly united so as to open to the fullest extent to receive the full diameter of the pipe to be inverted and folded for packing purposes, and to be closely fitted and locked upon the pipe when in service.

DETACHABLE HANDLE FOR PANS.—No. 906,801; December 15, 1908. E. Hickey, Sawyers Bar, Cal. The object of this invention is to provide a handle having clamps suitably disposed so that the handle may be readily affixed to any pan or utensil for the purpose of lifting or carrying the same, and may be detached and removed whenever desirable. The device may be a two-part one, one portion being threaded with relation to the other, and the handle turnable so as to draw the jaws together, or separate them.

METHOD OF MINING.—No. 906,765; December 15, 1908. W. G. Anderson, Smuggler, Colo. The object of this invention is to provide a system whereby in mining it is only necessary to take out the more valuable portions of the ore, using the refuse and waste taken from development to fill in the worked out stopes, thus doing away with the hoisting of a great quantity of worthless material to the surface. The invention provides an economical method of timbering, and also a cheap way of breaking out the ore and loading the cars.

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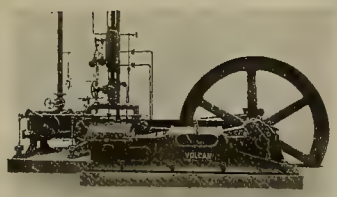
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AT CLOSE OF BUSINESS NOVEMBER 27, 1908

ASSETS.

Loans and Discounts		$14,352,027.76
United States Bonds		6,535,282.82
Other Bonds		2,955,311.09
Customers' Liability on Letters of Credit		1,415,791.33
Bank Premises		1,041,048.97
Money on Hand	$5,489,683.97	
Due from Banks	7,310,764.59	12,800,448.56
Redemption Fund with U. S. Treasurer		290,000.00
		$39,389,910.53

LIABILITIES.

Capital	$ 6,000,000.00
Surplus and Undivided Profits	4,785,996.41
Sterling Credits, etc	1,415,791.33
National Bank Notes	5,761,000.00
Reserved for Taxes	32,380.05
Deposits	21,394,742.74
	$39,389,910.53

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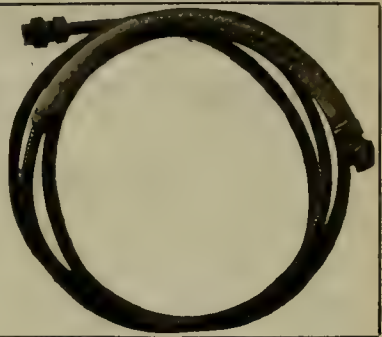
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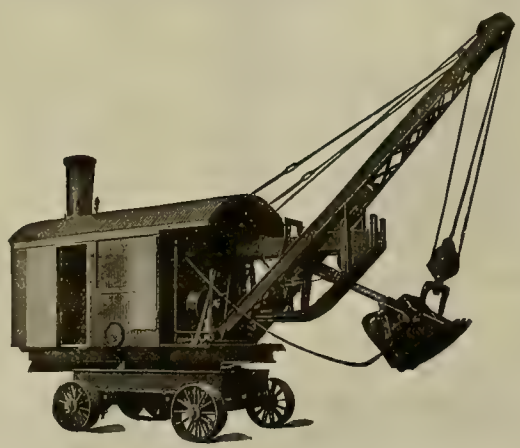
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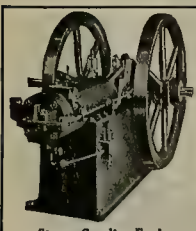
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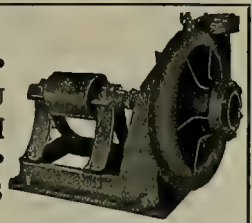
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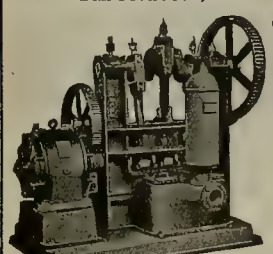
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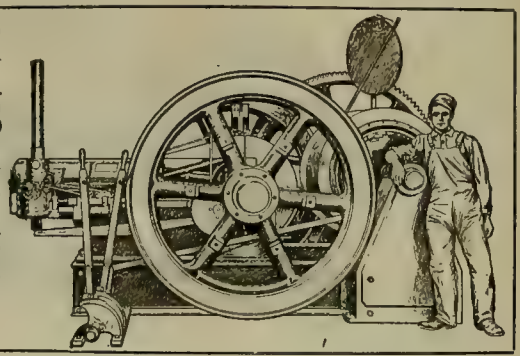
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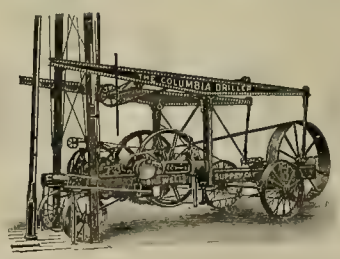
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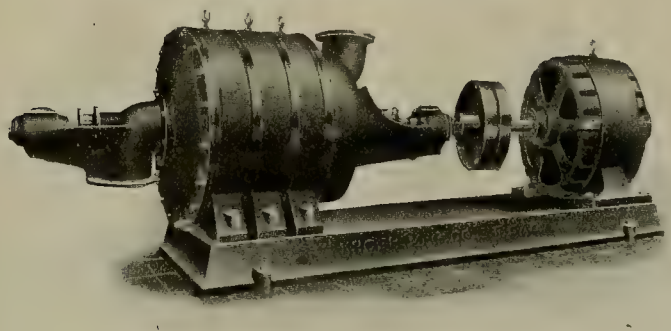
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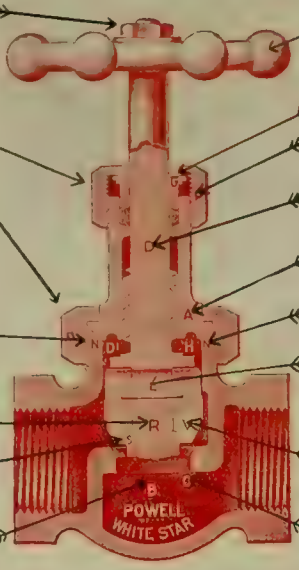
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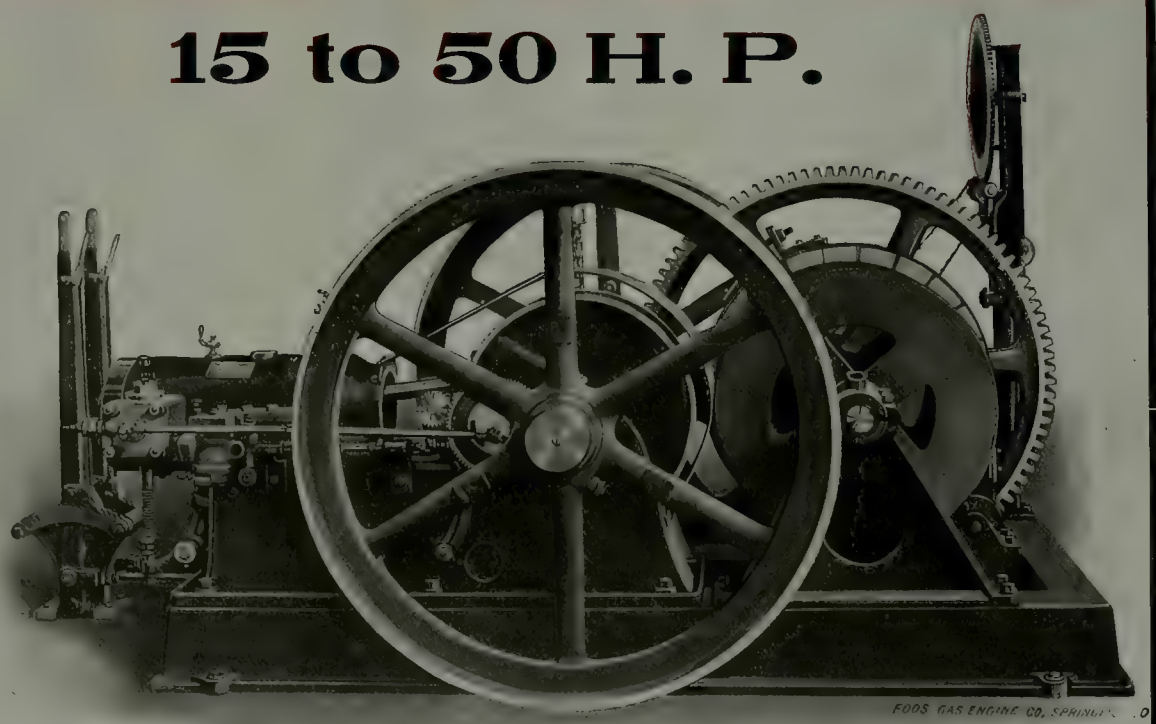
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EDITORIAL.

IT IS a pleasure to record that Mr. Lewis H. Beason, who has long served the MINING AND SCIENTIFIC PRESS as special correspondent at Salt Lake City, has become editor of the *Pioche Record*, at Pioche, Nevada. We tender Mr. Beason our best wishes for success in his new venture.

MINING MEN interested in northern Mexico will be glad that the Yaqui troubles in Sonora seem to be at an end. About 5000 of these Indians surrendered at Nogales on January 4 and signed a treaty of peace. Some of the tribe remain in the hills, but their chief Bulle has promised to aid the Mexican government in pacifying them.

IRON statistics are said to furnish a barometer of trade. This is measurably true. Orders are placed so far ahead, however, as to modify the sensitiveness of this commercial indicator. The extent of the depression in 1908 is shown by the fact that the output of iron from the furnaces of the United States was only 15,486,606 tons, as compared to 25,292,335 tons in 1907 and 24,749,984 tons in 1906.

GOLD production in the Philippines made an extraordinary advance in 1908. From 64,700 fine ounces the year before there was a sudden leap to 306,708. These are official statistics, representing receipts at the Mints of the United States and purchases by the American Smelting & Refining Company. Considerable quantities of Philippine gold are marketed in other countries, but no estimate of such contributions to the output is attempted in the figures given. The possibilities for mining in our eastern dependency are attracting the attention of capitalists.

THIS is the season when the statistician takes himself seriously and the public absorbs columns of crude arithmetic in the fond belief that they express irrefragable facts. Of course, there are statisticians and statisticians, from the serious but misguided scientific men who reduce order out of a numerical chaos to the irresponsible compilers of the local newspaper, anxious to boost its own habitat as the unfailing source of mineral, agricultural, or manufactured wealth. This is the season when daily papers publish annual reviews that cover anything from 60 to 170 pages devoted to weirdly inaccurate pictures of wonderful progress and strangely contradictory figures proving—just what they want to prove. Some of the performances are completed a week before the year is ended, as if to emphasize the fact that the editors hate to be harrassed by too many facts. To quote one amateur statistician when

deriding his competitors, their premature New Year's editions are "glaring products of inaccuracy, mendacity, and general slipshod methods." In the end the public gets more smoke than light, and carries away only a general idea of plethoric productiveness, a small share of which each individual hopes will fall into his lap. Another effect is to throw doubt on all statistical statements and to warrant a discounting that reduces their educative value to a minimum.

FROM a brief report issued by Mr. R. D. George, State Geologist of Colorado, we note with pleasure the earnest effort that has been made by him and his assistants to furnish Colorado with geological investigations of practical value. This work was done in the summer of 1908, despite the failure of the Legislature to provide the necessary funds, so that the final reports and maps were delayed in publication. The State Geologist and Mr. R. D. Crawford lent their credit and gave their services to the State, hoping for reimbursement later. It is wholly discreditable to a mining region of such importance that the necessary work of its Survey should be hampered in this petty manner. We congratulate Mr. George on a notable exhibition of public spirit and scientific industry.

ADOPTION of a new process at a new mine is one of the common indiscretions of the novice. He is easily persuaded that the ore is 'rebellious', and the promoter has ready the new-process man with his improved solution of the peculiar metallurgical difficulty as another means of wasting the new investor's money. But it is remarkable that a great corporation such as the Tankanyika Concessions, Limited, should announce officially a program involving methods of copper metallurgy that lack the approving stamp of experience. It appears that the copper deposits at Katanga, in Central Africa, include large quantities of excessively silicious oxidized ore containing as much as 10 per cent copper. It is proposed to treat this class of ore by reducing the copper to the metallic state, followed by mechanical concentration. On a laboratory scale no doubt a process of this kind will yield the metal, but as concentration is practiced today this will entail a loss of 18 to 30 per cent, according to the fineness of the metallic particles. A large part of the metal resulting from the reduction of oxides and carbonates without fusion would undoubtedly exist in a fine state of subdivision. Perhaps the Tanganyika Concessions has developed a feasible process, but the failures attending such attempts elsewhere in the past would hardly recommend experiments of this nature in the heart of Africa. If it be a question of getting something at a profit from otherwise wholly unavailable ores, regardless of the percentage of loss, then as a matter of business it might become warrantable, but the announcement made bears the suspicious appearance of the 'new process', still wanting its Q.E.D. Metallurgical inventions need to be put on probation near at home, where failures will not be damagingly expensive.

The Italian Earthquake.

The calamity that has befallen the communities dwelling on the Straits of Messina has elicited the understanding sympathy of the people of San Francisco. While the earthquake of April, 1906, did less damage than the succeeding conflagration, the terrifying aspects of that mysterious natural disturbance are vividly remembered. With us the damage arose from the complexity of civilized ways of living, whereby the illuminating gas escaping from broken pipes was ignited by the short-circuiting of electric wires thrown out of place, and superadded to this prime factor was the destruction of the water conduits that otherwise would have been instrumental in extinguishing a multiplicity of fires. On the Tyrrhenian coastlands of Italy the loss of life was incomparably greater because the population was congested in badly built dwellings. The ordinary Sicilian house is constructed of boulders loosely held in poor mortar, and it needs but a small earth-jar to bring such walls to the ground. Therefore an earthquake of unusual severity plays dreadful havoc. Whether the estimated loss of life be exaggerated, and whether the dead be numbered by 100,000 or 200,000, it is certain that the destruction of Messina, Reggio, and the neighboring cities constitutes one of the greatest catastrophes of history. If we do not feel the horror of it as much as we might, it is because every day our newspapers devote pages to the sordid details of lesser tragedies; even our sense of the value of human life has been lessened by the frequency of accidents on railroads and in coal mines, on street railways, and in theatre panics. The emotions of the American are jaded with a daily iteration of horrors. All the more, therefore, is it remarkable that the fate of the Italian unfortunates should have awakened such instant sympathy, expressed promptly, by word and deed. More than money or message, the United States offers an asylum for the houseless people of Calabria and Sicily; we shall see a large influx of immigrants from southern Italy. Whether they be welcome or not, their coming will certify to the fact that for the oppressed and unfortunate of every country there is still a land where a new start can be made, and where a new home may be built. That, after all, is the greatest service America can render Italy in this dark hour.

Another phase is presented when we recall the fact that the country devastated during the closing days of 1908 has been the theatre of seismic forces since the dawn of history. Etna has thrown a cloud over the battles of the Punic war, Vesuvius lighted the revels of the Romans, and Stromboli, the lighthouse of the Mediterranean, has been a guide alike to the Greek and to the Latin navigators. The idylls of Theocritus were written among the villages of Sicily; on her plains the Norman and the Saracen fought; in her valleys was grown the wheat that fed Athens and Rome. For twenty-seven centuries this beautiful land has been the dwelling place of the most advanced communities of the old world, despite the fact that it lay close to the edge of a volcano,

and on the vibrating edge of a shifting portion of the earth's crust. Why do men continue to pitch their dwellings in such dangerous places? Because the intervals between great catastrophes are greater than the period of a generation, and therefore rarely befall more than once in the life of an individual. The last big Calabrian earthquake was in 1783, and undoubtedly it was to the well informed Sicilian of today but a remote scientific fact having no direct bearing upon his own happiness. Moreover, men think all men mortal but themselves; if an earthquake come, each expects to survive, and if any house be ruined, it will be his neighbor's. Finally, where Nature is unkind with her left hand, she is generous with her right. The harbor of Messina brought wealth to thousands, and the plains of Sicily enriched generations; they were willing to take the risk in exchange for the advantages offered. And so for a period covering the written record of humanity the wheat of Sicily and the wine of Calabria have been gathered under sunny skies and beside blue waters in defiance of the volcanic ashes that might darken the heavens or the mysterious unrest that might waken the sea to deeds of horror. The harbor of Messina was the haven of the Mediterranean after an earthquake, as before; the bay of San Francisco attracted the shipping of the Pacific before 1906 and after. Geologic forces have not hurt Sicily so much as the clash of armies. Latin and Greek, Roman and Carthaginian, Norman and Saracen. Geologic faults have made less of a rift in San Francisco than the deeper fault of a lost sense of civic decency. We have overcome the effects of the first with triumphant energy and incomparable courage; we still cower under the morally emasculating agencies of an incivism that even the earthquake could not exorcize, that even the fire could not refine.

Revival of Gold Dredging.

Not long ago it seemed as if the application of the dredge to gold mining were destined to be restricted to one or two localities and to enterprises of small proportions. In the south island of New Zealand, in New South Wales, in the upper watershed of the Ovens and its tributaries in Victoria, a number of small dredges were earning a profit for their owners, but the sum total of production and, fortunately, of capital invested was small. These enterprises continue to make fairly satisfactory returns, but taken collectively their yield is hardly equal to that of one big lode mine. In America, the dredges in Montana, in Colorado, in Idaho, and in other Western States have had an encouraging measure of success. In more distant regions, such as Tierra del Fuego, Bolivia, Brazil, Burma, West Africa, and Dutch Guiana the dredge has been digging laboriously and with varying results. In Siberia and in British Columbia dredging enterprises on a large scale have been undertaken, but the profit has been nothing to boast of. Many have been attracted by the supposed absence of risk in dredging because of the certainty with which the ground can be tested, and this supposed certainty has been the excuse for carelessness in prospecting such as would ensure failure in any form of mining enterprise. Nevertheless, the only region where the dredging industry assumed large dimensions was in California: at Oroville, on the Feather river, first, and subsequently in the valley of the Yuba, near Marysville, and on the American river, near Folsom. These three localities may be grouped as parts of the central California dredging region. At the present time not less than 45 dredges are in operation in this region, producing $5,500,000 per annum. One of these dredging companies, namely, the Yuba Consolidated, is much the most productive gold mine in California; in fact, it produces as much gold as the two richest lode mines in the State, the North Star and the Kennedy. The Yuba Consolidated has 12 dredges at work, digging 80 feet, of which 58 feet is below water and 12 feet above that level; the gross yield is $1,650,000 per year, the net profit is $1,200,000; the gravel yields 21 cents per cubic yard and is worked at a total cost of 5 cents per cubic yard; so that fully 75 per cent of the gold won represents dividends. This is a splendid mine. There are 14 dredges in other parts of California, notably at Redding and at Snelling, from which good returns are expected. Thus there are 59 dredges in California, producing in excess of $6,000,000 per annum. These facts, now generally known, have stimulated the search for dredgeable ground. Prospecting and testing of alluvial flats have been undertaken in many corners of the world, especially in Alaska and the Yukon. In the North there are 12 dredges digging profitably, including the 7 operated by the Yukon Gold Company at Dawson. On the Stewart, the Forty-Mile, the Sclomon, and other rivers near the Arctic Circle a season of four to five months is spent industriously in the extraction of gold from deposits of unusual richness and occurring under exceptional conditions. Next season several new dredges will be started, and if they utilize the experience in method and machinery now available they ought to do well. During the past summer two or three expeditions have been sent to Colombia and the result has been that engineers of established reputation have recommended the construction of dredges to exploit ground already tested systematically with churn-drills. In Siberia several American engineers versed in this branch of mining have found areas suitable for dredging and English-Russian companies are preparing to make a start. Other countries might be specified, but the facts stated suffice to prove a general increase of interest in this branch of mining. It seems warranted. To the younger men of the profession this expansion offers a new field for their energies. The use of the churn-drill in testing alluvial ground and experience in making proper inferences from such bore-holes, have given a valuable tool to the engineer. Drilling affords a method for reliable sampling. Co-operation between the manufacturers of machinery and the men that use it has resulted in the designing of dredges as much stronger and more efficient than the feeble digging-machines of ten years ago as a modern battleship is more powerful than the war-vessel of discarded type. The training of efficient dredge-masters renders it

unnecessary to consign a complicated mechanism to the control of a farmer or of a book-keeper.

In a recent article we referred to the fact that 65 dredges had been built for the North and of these 12 were successful enterprises. To those who think hastily, but not profoundly, this proportion, of about one success to four failures, looks discouraging. As compared to the average result of business enterprise or industrial adventure, the proportion is high. To one who has investigated the conditions under which dredging was applied in the North and the low average of skill available in the efforts as yet made toward overcoming local difficulties, it is astonishing that so many successes should have been won. Assuredly, there is good augury for the future. When operators have learned that careful sampling with drills and shafts is as necessary in dredging as the breaking of assay-samples preliminary to vein mining; when they have been impressed with the fact that cheap machinery is often the most costly; that experienced dredge-masters are essential; that it is as profitable to bite a file as to dredge frozen ground—then the way will be clear for a proportion of success that may be augmented to a beatific maximum.

Financial Confidence.

It is an impressive fact that the annual output of mineral wealth in the United States has reached the magnificent value of two billion dollars. This is double the production of eight years ago. In the same period the value of farm products has increased at a lower rate, the agricultural gain being about 65 per cent. The relation between mineral and agricultural production in a country of imperial dimensions is an intimate one. At bottom the disparity between the two has probably been the chief cause of the rise in prices, so conspicuous a feature of the last decade. Mineral production is the basis of manufacturing; it calls for more workers, and that means more to feed and to clothe. If the supply does not come forth in proportion to the demand, the inevitable result is higher costs of staple necessaries; this is at once reflected in the costs of manufactured articles through an advance in wages to meet the expenses of living. Thus also is explained the 'land hunger' which is leading on the one side to pioneer enterprise in undeveloped territory, and on the other to reclamation projects and to more intensive methods of agriculture. Instead of looking to artificial causes for an explanation of the recent financial stringency, or accusing the gold output of responsibility in the case, it is evident that in these simple relations between the primary additions to the world's wealth is found a fundamental reason. Exchange, in the last analysis, is effected on the credit system; gold is only the conventional measure of value, and serves to settle the balances that constitute a trifling fraction of the total volume of business. The enormous areas of land being reclaimed in the South and West, and in Canada, and the great tracts just being opened to colonization in Mexico by the building of railroads, will exercise an important influence in providing means for taking care of the mineral output of this country at its present high level.

The enormous industrial expansion, which has received a momentary check, began about ten years ago. This is so nearly contemporary with the evolution of electric appliances to a high state of economic efficiency that many have attributed the phenomenal demand for mineral products to the development of this new agent. The world had never before witnessed so large a growth of business; such colossal enterprises had never before been undertaken; nor had mining ever played so large a part in the transactions of capitalists. It became less the sport and more the serious concern of business men. The extended application of electricity was unquestionably an important factor in the expansion of the mineral industry; the call for one metal makes demand for others. No forms of human endeavor stand alone; they are intimately correlated. The advance in electrical appliances was matched by progress in every department of the mechanical arts. In short, the world stood ready, with improved machinery, and more highly perfected methods, to utilize natural resources upon a grander scale. In view of this, the financial depression of the past year is not comparable with those that preceded it. There were new causes operating, and the steady call for metals during 1908 is evidence of an enlarged consuming power. A pronounced feature of the year just ended has been the absolute indifference of the agricultural centres to the prevailing depression. They have been unconscious of its existence; prices of food-stuffs have not receded. This shows that the mineral production had not surpassed the world's need so much as that the conditions of production had grown too costly. The inevitable result is to stimulate agriculture to bring about a truer balance. The London *Economist* index number in June, 1907, was 2601, the highest point reached in 30 years, indicating that the relation between cost of living and earning power was abnormally strained. Under such conditions a reaction was inevitable, and greater conservatism in business would necessarily follow. This is reflected strongly in the diminution of failures by 25 per cent from the previous year. In line with this evidence of conservatism is the reflex of slackened trading shown in the 15 per cent reduction of bank clearings. The lesson to be deduced from the conditions observed in 1908 is that actual over-production of manufactures had not occurred; that the development of natural resources had proceeded at so rapid a pace under the stimulus of improved mechanical facilities as to overtax available supplies of the necessaries of life; that artificial governmental interferences with business affairs brought about retaliations unsettling normal business relations, and accentuating distrust; but that the expansion of industry had so enlarged the demand for supplies of every kind as to prevent collapse of enterprise. In fine, business is progressing in a conservative manner, and will continue to progress while the mineral output leads the agricultural, unless overstrain be induced, as happened in 1907.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

O. B. PERRY is in London.

W. P. HAMMON is in Europe.

PHILIP L. FOSTER is at El Oro.

H. C. HOOVER is at Monterey.

HENRY F. LEFEVRE is at New York.

JOHN HAYS HAMMOND is at Augusta, Georgia.

F. W. BRADLEY is on his way to El Oro, Mexico.

H. W. TURNER has gone to Lincoln county, Nevada.

HOWARD D. SMITH has returned from Grass Valley.

H. T. BURLS has left London, on a visit to Mexico.

JOHN J. BURKE is examining mines at Pachuca, Mexico.

D. C. JACKLING was at Los Angeles on New Year's day.

A. C. BEATTY has rented a house at Santa Barbara until May.

H. A. TITCOMB is now in Japan, on a voyage around the world.

PERCY L. FEARN has returned to Guatemala from New York.

H. C. CUTLER has returned to Goldfield from Sonora, Mexico.

NICHOLAS J. MARTIN was in San Francisco, on his way from Nicaragua to Seattle.

A. CHESTER THOMAS has returned from New York to Santa Barbara, California.

J. S. WILLIAMS, Jr., is superintendent of the Moctezuma mine, at Nocozari, in Sonora.

E. NELSON FELL has left London for Colombia, to examine the Frontino & Bolivia mine.

J. GORDON HARDY is now manager of the La Republica mine, near Ocampo, in Chihuahua.

EDWARD H. COOK announces a change of residence from Tucson, Arizona, to El Paso, Texas.

GEORGE A. PACKARD, of Boston, was in San Francisco, and has gone to Shasta county, California.

F. W. RIDLEY has been appointed superintendent of the Allouez and Centennial mines, Michigan.

THOMAS PASCOE, superintendent of the South Mount Boppy mine, New South Wales, is expected in London.

H. S. MUNROE, of Joliet, Ill., will be at Baca, Distrito del Fuerte, in Sinaloa, Mexico, during January and February.

EDWARD H. NUTTER has resigned as superintendent for the Liberty Bell Gold Mining Co., of Boston and Colorado.

PELHAM V. COOPER, assistant manager of the Black Butte quicksilver mine, Oregon, was in San Francisco for a few days.

F. O. HARVEY has formed a partnership with A. G. B. WILBRAHAM, with offices at No. 2 Laurence Pountney Hill, London.

WILLARD S. MORSE has resigned as metallurgical engineer with the American Smelting & Refining Co., and will reside at Denver.

WILFRED RICKARD, formerly of Wisconsin, is manager of the Victoria Quartz mine, at Bendigo, the deepest gold mine in the world.

ELTON W. WALKER has resigned as superintendent for the Tombstone Con. Mines Co., to take effect on February 1, after which date he will be in consulting practice at Detroit, Michigan.

T. C. CHAMBERLIN, professor of geology in the University of Chicago, accompanied by his son, R. T. CHAMBERLIN, sailed from San Francisco for Japan on January 9, on his way to make a study of the resources of China, in behalf of a special educational commission sent thither by the University of Chicago.

Latest Market Reports.

LOCAL METAL PRICES—January 7.

Antimony	12@16c	Quicksilver (flask)	$45@46
Casting Copper (scrap)	8½@13½c	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Dec. 30. £. s. d.	Jan. 7. £. s. d.
Camp Bird	0 16 0	0 16 0
El Oro	1 6 3	1 6 0
Esperanza	3 6 0	3 4 6
Dolores	1 10 0	1 10 0
Oroville Dredging	0 8 0	0 8 9
Mexico Mines	4 18 9 ex. div.	5 0 0
Tomboy	0 18 9 ex. div.	0 18 9

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METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Dec. 18	14.06	4.20	5 14	48¼
" 19	14.06	4.20	5.14	48½
" 20	Sunday.	No market.		
" 21	14.06	4.20	5.14	48⅝
" 22	14,06	4.19	5.14	48½
" 23	14.06	4.19	5.14	48¾
" 24	14.06	4.19	5.14	49⅜
" 25	Holiday.	No market.		
" 26	14.06	4.13	5.14	—
" 27	Sunday.	No market.		
" 28	14.06	4.13	5.14	49¾
" 29	14.18	4.13	5.14	49¾
" 30	14.18	4.13	5.14	50⅛
" 31	14.18	4.13	5.14	50¼
Jan. 1	Holiday.	No market.		
" 2	14.25	4.20	5.18	50¼
" 3	Sunday.	No market.		
" 4	14.31	4.20	5.18	50⅜
" 5	14.31	4.20	5.18	50½
" 6	14.31	4.20	5.18	50⅜
" 7	14.31	4.20	5.18	51½

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Dec. 30.	Jan. 7.
Amalgamated Copper	83½	84⅜
American Smelting & Refining Co.	82¾	89
Boston Copper	16½	16½
Butte Coalition	26½	26⅜
Cumberland Ely	8¼	8
Dolores	6¾	6½
El Rayo	3⅜	3⅜
Giroux	6¼	7
Greene-Cananea	12⅛	12¼
Indiana Sonora	4½	4½
La Rose	6⅞	6⅝
Miami Copper	15	15
Nevada Consolidated	19⅛	18⅝
Newhouse	5⅞	5⅝
Nipissing	9¼	9⅞
Ohio Copper	5⅜	6⅜
Tennessee Copper	44⅞	47¼
Utah Copper	46⅞	46¼
Yukon	4½	4⅜

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. January 7.		Closing prices. January .
Adventure	9⅞	Michigan	13
Ahmeek	140	Mohawk	70¼
Allouez	37¼	Nevada Con	18⅜
Amalgamated	84¼	North Butte	84
Arcadian	3⅛	Old Dominion	56¾
Atlantic	17½	Parrot	29¼
Butte Coalition	26½	Quincy	93½
Calumet & Arizona	117¼	Rhode Island	5
Calumet & Hecla	660	Shannon	17⅛
Centennial	32⅝	Superior & Pittsburg	17⅜
Copper Range	80½	Tamarack	78
Cumberland Ely	8	Trinity	16⅞
Daly-West	10	United Copper Con	15⅜
Franklin	15½	Utah Copper	45¼
Granby	108	Victoria	3⅜
Greene-Cananea, ctf	12¼	Winona	6⅛
Isle Royale	24¼	Wolverine	151
Mass	5½	Yukon	4¼

Obituary.

R. H. HARLAND, of Lombard Court, London, died on November 25. He was a well known analyst and assayer, and was intimately connected with the cyanide process.

General Mining News.

ARIZONA.

COCHISE COUNTY.

Duffner Bros. have bonded the Duffner group of claims, between Paradise and Portal, to Homer Prickett and associates, of Douglas, who have already done the assessment work. The consideration is not stated.——The Shattuck-Arizona Co. has resumed active operations and the first shipment of ore to the smelter since November 1907 has been made. The first consignment amounted to four carloads, or nearly 200 tons. About 60 men are employed and the management expects to mine and ship from 80 to 100 tons per day.——At the new Powell shaft of the Pittsburg & Duluth Mining Co., being sunk on the dividing line of the Hope and Wagner claims, the steam for the hoists will be piped 1350 ft. from the old plant. The equipment consists of two 75-hp. Atlas boilers, a two-drum Hendrie & Bolthoff hoisting engine, a Sullivan air-compressor, oil pumps, and minor equipment. The Pittsburg & Duluth plant will be used for hoisting Powell ores and for this purpose the old head-frame is being re-built.

MOHAVE COUNTY.

A. L. Derbyshire is at Gold Flat preparing to work the Abe Lincoln mine, north of McConnico, upon which he has



Sacramento Shaft of the Copper Queen Mine, at Bisbee.

a bond. A shaft is to be sunk to a depth of 200 ft. at once. ——The Yucca Cyanide M. & M. Co. will start work soon upon its San Francisco mine. The new work will be done below the 600-ft. level. W. C. Merry, of Cedar, is assistant superintendent.——Work has been commenced on the Cruz mine, near Cedar, by M. J. Ryan and others, of San Diego. A company has not yet been formed, but exploratory work is undertaken by nine business men of that city. It is the intention of the company to sink a shaft to a depth of several hundred feet. The surface ores were the richest ever taken from a property in that part of Mohave county.

PINAL COUNTY.

In the Ray-Kelvin district conditions are improving daily and the past month has shown a great increase in activities. The Ray Consolidated Copper Co. is pushing its development and prospect work. The Madeline shaft of the Kelvin Calumet Co. has been leased and the Ray company is exploring some of its ground which lies directly in the rear through this shaft. The Ray company at present has eleven large churn-drills at work day and night; four of the machines are Keystone and seven Star, employing about 75 men. There is also other development work being done over a large part of the property. The mill at Kelvin, six miles distant, which has been overhauled and re-modeled, will be in operation in the near future and will handle 350 tons of ore per day. The plan of the company is to block out the entire property and eventually erect a large plant for treating the ore.——The Christmas Gift mines, near Saddle Mtn., are to be worked by a syndicate of British people, of which Capt. C. E. Birchman of Liverpool is the head. The property was located on Christmas day, 1882, and the company now owning them paid $200,000 for it.

SANTA CRUZ COUNTY.

The shaft at the Pittsburg mine, in the Santa Rita mountains, is now down almost 200 ft. From the 160-ft. level a cross-cut was run north, striking the vein 18 ft. from the shaft and cutting through 8 ft. of good concentrating copper ore. Sinking was continued and the shaft is now bottomed in ore of a good grade. The showing is so good that T. A. Cox, general manager for the Arizona Pittsburg company, owning the property, has gone to Pittsburg to talk matters over with the directors of the company in regard to putting in heavier machinery.——The Bland Mining Co. will start operations early in the spring on its property in the Harshaw district. W. M. Schwartz, of Kansas City, Missouri, will have charge of the mine. The Bland company is composed of Kansas City people.——The Douglas-Arizona & Sonora Development Co., of which L. M. Raines is president and P. J. McIntyre is treasurer, has purchased from W. M. Murphy and associates and Robert Daly and associates two groups of mining claims adjoining the World's Fair mine, in the Harshaw district. It is understood that the purchasing company will at once do a large amount of development work on these claims, and will employ a good force of men.

YAVAPAI COUNTY.

The Golden Ridge M. & M. Co. is working three groups of claims in the Weaver district and expects to increase the working force on each as soon as the camp accommodations are ready. E. A. Wing, who is general manager, has recently returned from Memphis, Tennessee, where he went to consult with stockholders. It is rumored that the Arizona Copper Belt Co., whose property is south of Constellation, expects to erect a 10-stamp mill.

CALIFORNIA.

NEVADA COUNTY.

(Special Correspondence.)—The Donovan and Torpie & Schroeder claims, in the Rough and Ready district, have been bonded by H. M. Black, representing Eastern capital. ——A new 10-stamp mill and centrifugal pump with a capacity of 200 gal. have been installed at the Golden Gate mine. An electric power line will be built to carry a direct current to operate the hoist and pump. A good reserve of milling ore has been developed. W. H. Martin is superintendent.——A 200-ft. shaft has been sunk at the Weeks mine and a 4-ft. body of mineralized ore opened up by cross-cutting at this point. The owners are arranging for a test crushing of 100 tons.——The unwatering of the shaft at the Yuba mine is progressing rapidly, and it is expected to have the lower levels clear within a few more days. This will be the first time in many years that the mine has been free of water. The mill is running one shift on ore from above the 400-ft. level.——At the Grey Eagle, sinking is going on at three different points. Enough ore is being taken out in the course of developments to keep the 10-stamp mill in operation.——The new shaft at the Alaska mine has nearly reached the level of the old workings, and a cross-cut will be driven to connect. As soon as this has been completed, operations on a large scale will be commenced. The turbine pumps are handling the water easily. George St. John is superintendent.——The mill at the Idaho-Maryland is running on good ore from the 500-ft. level. Driving for the vein has commenced on the 1000-ft. level. The drift on the 700-ft. level will be pushed ahead steadily. About seventy men are now employed.——The North Star Mines presented the miners with $10, and the muckers and carmen with $5, on Christmas. The other mines provided refreshments for their employees.

Grass Valley, January 2.

SAN BERNARDINO COUNTY.

Some time during the coming week the Oro Belle Mines Co. will increase the force now employed in the north drift of Oro Belle No. 1. Two shifts are to be put on, and the drift continued farther north. Before January 10 the company expects to begin work on its new shaft, which will be sunk 300 ft.——The Atolia tungsten mine, near Johannesburg, has resumed with a large force of miners, and the development work will be pushed with energy. The closing of the mine last fall was due to the condition of the market, tungsten having taken a drop. Since then the price has gradually ascended, and now large profits are again in sight.

SHASTA COUNTY.

The California Consolidated Co. is reported to have cleaned up $10,000 in their November mill-run at the Gold Ball mine, near Sawyer's Bar.——The two blast-furnaces of the Balaklala smelter have been reinforced the past week by the blowing in of the two converters, and blister copper is now a regular product of the big Coram plant. Little difficulty has been met in the reduction of the Balaklala ore, and such incidental problems as are bound to come up from time to time in the early days of a great plant of this kind are yielding to solution and are being successfully met one after the other.

SIERRA COUNTY.

The gasoline hoist at the No Better shaft, at Forest, is completed and operation will soon be started.——It is rumored that the Finane brothers have bonded their quartz claim near Forest to a company which will develop the ground. This vein is the south extension of the Eureka, and has some good prospects.——The gravel-mill at the Omega mine is steadily working, and is said to crush 75 tons in 24 hours. Adam Keiffer has charge of the mill and J. McCoy runs it on the opposite shift. There are 30 men employed, and as they live at the mine the place resembles a small town.——A few more men were put on at the Telegraph mine this week, and there are now about thirty men there taking out gravel which will be washed when the water starts.

TRINITY COUNTY.

(Special Correspondence.)—The Golden Jubilee mine, six miles above Carrville, is the most important producing property in the northern portion of the county. Lying in the heart of the famous Coffee Creek district, the property has been worked at various times, with varying success, with several years of idleness also marking its career. Under a former management the property was practically worked out, no provision being made to keep developments ahead of mill requirements. Some few years after the closing of the property, due to the causes already indicated, the owners, principally Napa, California, investors, commenced operations on a more modern plan. New levels were run, improvements made to the reduction plant, and every endeavor made to develop a good reserve of ore. That this change in affairs has been uniformly successful is attested by the position that the Golden Jubilee now occupies. The Golden Jubilee vein is apparently characterized by a persistent fissure. The strike is north and south, with an easterly dip of about 70°. On the surface the vein has been traced for 6000 ft. from Boulder creek in a southerly direction. The vein varies from 20 in. to 16 ft., and assays from $10 to $40 per ton. The lowest level gives approximately 1000 ft. of backs, with the vein showing about six feet wide at this point. Four upper levels have been driven for considerable distances and have disclosed the vein at several points. From No. 1 level connections have been made with the lower workings by means of a double-compartment shaft. In all, approximately 4000 ft. of drifts have been extended. A new 10-stamp mill has been recently completed and will be placed in commission within a few weeks. It is several hundred feet below the old plant and is so situated that the lowest working level of the mine will be readily accessible. The cyanide plant is large enough to handle the pulp from 20 stamps, as it is intended to increase the capacity of the mill to 20, and possibly 30, stamps at a comparatively early date. The mill is operated by water-power, approximately 500 miner's inches falling 450 ft. The mill is arranged to handle amalgamating, concentrating, and cyaniding ores. In the case of amalgamation, the pulp will pass from the stamps into a plate-room, but if concentrating ore is being treated the product from the stamps will be run through classifiers and distributed to Willfley and Frue concentrators. The slime will be discharged into agitators and the gold recovered in cyanide solution. The sand will be conveyed to the cyanide plant and treated separately. In case the sand proves too coarse, it will be first re-ground in the Huntington mills and then passed to the cyanide tanks. The old plant consists of two 3½-ft. Huntington mills and a 20-ton cyanide plant. Although antiquated, this plant will be used as an auxiliary to the new mill, and is expected to be valuable in many ways. Blocks have been set for 20 additional stamps, and it is likely that these will be added in the course of the next two or three years. The property comprises seven claims, and at the present time 65 men are employed. The remoteness of the mine from a railway mitigates against it to a certain extent, inasmuch as it renders the shipping in of supplies and machinery expensive. The sole means of freighting between the railway station of Delta, the nearest commercial point, and the mine, is by means of mule-teams. An abundance of excellent timber and water is found throughout the district, and the climate is good throughout the year, despite the high altitude.

Weaverville, January 1.

COLORADO.

CLEAR CREEK COUNTY.

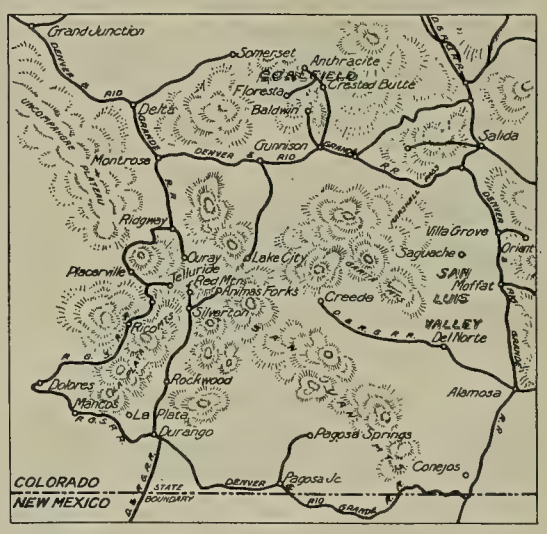
(Special Correspondence.)—The task of installing the Sigafoos boring machine at the Georgetown adit on Columbian Mtn. is progressing satisfactorily. The grading has all been completed, and now the building for the housing of the machinery is being put together. A greater portion of the machinery has been delivered on the ground, the heaviest piece of which weighs six tons. According to the terms of the contract, the machine must be ready to start by January 11, but it is possible that a few days delay will be experienced, owing to the fact that a pumping plant must be installed on Clear creek. This plant is to be installed at the expense of the Georgetown M. P. & T. T. Co., while other expenses incurred are to be borne by the American Rotary Tunnel Machine Co. It is understood that a large number of mining men from various parts of the State have signified their intention of being present to witness the tests that are to follow.——William Rogers, manager for the Santiago M. & M. Co., announces that he has in contemplation the construction of an aerial tramway which will start at the Santiago mine, in East Argentine, the terminus to be at the company mill in Georgetown. While the total length is not known definitely, as near as can be ascertained the distance will be 3½ miles. With this tram in operation, the vast bodies of ore in the Santiago mine workings can be delivered to market at a reduced cost of from $2 to $3 per ton. The various lessees at the property are breaking a heavy tonnage of smelting ore worth more than $50 per ton in gold, silver, lead, and copper. Especially is this true of the block of ground being operated on the second level by Rogers & Harper, where a body of ore is exposed in the stope that is five feet wide. It has been decided by the management to award no further leases, and as a result more men will be employed on company time.——W. Collins has taken a lease on the upper level of the Wide West, and in sinking a winze, to a depth of 12 ft., a streak of 500-oz. silver ore has been uncovered that is four inches wide. During the last 10 days from five to six sacks have been taken out daily, but as soon as the winze has been put down to the 50-ft. point driving is to be started. There is exposed alongside of the high-grade product a body of mineralized quartz, that assays 80 oz. silver per ton. It has been decided to leave this standing, pending a rise in the price of the white metal.——The

Argentine-Montezuma M. & T. Co. has resumed work in the advance of the Vidler adit. A contract has been awarded to William Goetz for the driving of the bore 200 ft., but it is understood that as soon as the work has been completed another contract will be given. The compressor-plant was started last week and the bore is going in at the rate of from six to seven feet per day. The Vidler tunnel on the eastern side of the range has been driven 3800 ft., while on the western side it is in 700 ft. The total distance to be driven is 7300 ft. before an outlet will be furnished for the ores of Summit county. There now remains less than 2800 ft. of ground to be broken before the connection is made.——The Hollingsworth M. Co. was organized this week, with a capitalization of $100,000. A group of claims on Sherman Mtn. will be developed upon a systematic scale, work having already been put under way. Orlando B. Smith of Silver Plume has been appointed manager.——The compressor for the Linn Con. M. & M. Co. arrived a few days ago, and now a force of men is putting it in place. Electric power will be used from the Two American Sisters plant. The new set of jigs for the concentrating plant has also arrived and is being put in place. Within 10 days everything will be in readiness for treating ore.——Ed. Butts returned this week from an Eastern trip, made in the interest of the Key West group of claims, on Leavenworth Mtn. His mission was entirely satisfactory, and already an active campaign of development has been put under way. It is intended to drive the adit, which is now in 700 ft., for 200 ft., for the intersecting of the Key West vein, which from shaft workings produced high-grade gold and silver-bearing ore.——The reconstruction of the aerial tramway running from the Pelican mill to the Seven-Thirty dumps is nearly completed. This tram will now run to the Pelican dumps, where large quantities of stuff are available that can be handled at a profit. W. A. Hood of Silver Plume is manager.——J. G. Hite has started work upon the Lamont group of claims, situated on Columbia Mtn. The adit, now in 400 ft., is to be driven steadily forward, some ore being in evidence at the present time. Denver capitalists have become interested in the enterprise.——A. B. Montgomery, of Denver, director in the Astor-Stewart M. & M. Co., stated a few days ago that the Western Metals Co. will shortly start work upon a new mill, the process being electrochemical. The plant is to be erected at the East Griffith mine, on Griffith Mtn., and will be fed upon ores from that property exclusively. It is claimed by this process the gold, silver, lead, and copper can be extracted in bullion form. W. D. Hoover, of Denver, is owner of the mine.——It is reported upon good authority that the Newhouse tunnel people, at Idaho Springs, will shortly start work upon the construction of a 500-ton milling plant. From what can be learned, it is the intention of the company to reserve one-fifth of the capacity for its own ores, while contracts will be entered into with various operators for the milling of the ores. This big bore, which is now in 17,400 ft., is being advanced, contracts having been entered into with the owners of property lying along its course that will necessitate its advance for another 4000 ft. It is a great boon for the district, as already a small army of miners has been given employment. W. H. Collins is manager.——J. J. Culley, manager of the Accord M. & M. Co., this week increased the working force, and within a short time regular shipments of smelting ore will be started. The adit is being driven forward, while driving is in progress upon both the Clyde and Pineo veins.——The Golden Glory T. M. Co. expects to increase the output during the present month from its Drummond mine on Columbian Mtn. Driving is being carried forward, while the winze is being given another lift of 75 ft. Orebodies are exposed in both places and the product mills from $40 to $45 per ton in silver and lead. At the Golden Glory adit a force of men is being employed and the bore is being driven steadily forward. It is expected that the extension of the Bellevue-Hudson vein will be reached within 60 ft. J. L. Young, of Lawson, is manager.——F. Percy, of Idaho Springs, this week resumed work upon the Chicago adit holdings, situated up Chicago creek. The bore will be driven steadily forward, as a large group of claims is controlled.——The Gold Anchor mill, which has been re-modeled, was put into commission this week and from this time forward will be kept running night and day. There are immense bodies of ore exposed throughout the various workings of the mine, all of which can be handled at a profit.

Georgetown, January 2.

LAKE COUNTY.

Steady work has been maintained on the Matchless since the decision of Judge Cavender gave temporary possession of the property to the lessees. Operations are being carried on in the No. 7 shaft, through which the ore is hoisted. A promising streak of silver was opened there some time ago, and the present production is coming in the greater part from this vein. Several carloads can be shipped every week, it is thought, if the work is not further interfered with. Henry B. Stevens, T. M. Raney, and associates are temporarily in possession of the Matchless mining property on Fryer hill as the result of a decision rendered by Judge Cavender in the District Court, but Mrs. Elizabeth Tabor, the owner of the mine, threatens to bring injunction proceedings restraining them from working it, on the claim that they have forfeited their lease by violating their con-



Map of Southwestern Colorado.

tract. The main point involved in the controversy, according to the opinion of Judge Cavender, is the terms of settlement between Mrs. Tabor and the lessees, of the smelter returns. Mrs. Tabor claims that she should be paid her royalty upon the gross smelter returns, while the lessees contend that the lease calls for her royalty, not before the hauling and switching charges have been deducted.——Work on the Progressive property, which was opened under a new set of lessees during the early part of last week, is reported to be more than favorable. The old shaft has been almost completely drained. A good plant of machinery has been placed in commission. Work through the old drifts of the mine will be taken up at once. It is figured that the first ore shipments will be made before long.——About 20 men are now employed on the A. Y. & Minnie property, in California gulch. Shipping was started last week. The output goes to the chemical works in Denver. The work of cleaning up some of the drifts is not yet complete, and as soon as they are made ready, the working force of the mine will be increased. It is expected that the property will be running in full blast within two weeks.——Thomas F. Gilroy and associates, who are sinking a new shaft on the Across the Ocean group, in Big Evans gulch, have reached a depth of 50 ft. Progress is necessarily slow, as they are in hard ground. The property is below the Penn and Big Six mines and in territory which is considered valuable.

SAN JUAN COUNTY.

The Mogul company is working a force of six men in prospecting on the group of claims above Gladstone owned by the late W. A. Walter. These claims were held for many years by Mr. Walter, who did a great deal of work and had good prospects. The Mogul company is operating them under a bond and is earnestly pushing the work to find the orebodies which the property is thought to possess.——The Des Ouray, which lies in Poughkeepsie gulch, along the line between San Juan and Ouray counties, is to be worked as actively as circumstances will permit throughout the winter. A body of ore was cut some months ago in running a cross-cut from the main development adit.——The San Antonio is well in the lead as the greatest shipper of crude ore in the entire San Juan for the year 1908. The season's shipments from the San Antonio since the railroad was opened to Red Mountain in the latter part of June, until the end of December, will number 200 cars—approximately 5000 tons of crude ore—of a net smelter returns value of about $100,000. This is a remarkable showing for a mine only in its second year; two years ago it was only a little prospect hole with but 35 ft. of development work.

TELLER COUNTY.

The year's output of the Cripple Creek district is estimated to be $16,230,525, representing a tonnage of 770,978. The maximum month's production was in August, when the tonnage was 68,886. The production for 1908 exceeds that of 1907 by $3,155,533. The average value of all ore from the district was approximately $21.——The Blue Diamond Mines Co., owning approximately 123 acres of patented properties in different sections of the district, has leased its Waterloo claim, on Ironclad hill, for a long term to Curtis J. Smith, president and general manager of the Michorado Gold Mining Co., owning the Seven-Thirty claim adjoining. A deep shaft is being sunk near the dividing line between the two properties, and both will be developed therefrom. Applications for leases on other holdings of the company have been filed with the secretary and will be acted on at the next meeting of the directors, to be held early in the month.——Work will be resumed on the Rose Nichol Gold Mining Co.'s group of fractional claims, containing 10 acres in a solid tract on Battle mountain and Bull hill. Charles S. Walden, the well known mining man of Victor, has formed a new leasing company to operate this group, and the lease from the company will be dated January 1. The main shaft on the Rose Nichol group has been sunk to a depth of 600 ft., and in excess of 3500 ft. of lateral drifts and cross-cuts have been carried in the development of the mine, which has produced to date approximately $12,000.——Operations have been resumed after six years of inactivity, by the Cripple Creek Land & Mining Co., owning a large acreage north of and adjacent to the corporate boundary of Cripple Creek. A shaft is being sunk from the surface on the Emma Palmer placer. A depth of 20 ft. has been reached and an electric hoist is to be shortly installed. In an old discovery shaft, sunk in the gulch several years ago, now caved and filled with mud and refuse, a strong vein was exposed at bedrock. W. F. Burns, who is manager of the owning corporation, is authority for the statement that ore from this vein gave returns of $16 gold and as high as 105 oz. silver per ton. The new shaft is to be carried to a depth of 100 ft. before lateral work is attempted, but at this depth a cross-cut will be carried over to the discovery vein.

IDAHO.

SHOSHONE COUNTY.

(Special Correspondence.)—The most significant feature of mining in the Coeur d'Alene throughout the past week has been the formal opening of the Idaho-Northern railroad December 30. The opening was the occasion for a great celebration throughout the whole of the North Side, and special trains were run from both Wallace and Spokane over the new line. It is expected that both regular freight and passenger trains will be put on the line by the middle of January.——The Bear Top Mining Co., operating one of the biggest and most extensively developed properties on the North side, is advertising for bids for 460 ft. of raise, to connect the No. 2 and 3 levels, and putting the mine in a position to commence shipments of ore as soon as the railroad facilities will permit. It is estimated that there is $360,000 of shipping and $200,000 of concentrating ore in sight at the present time. The mine is fully equipped with all necessary machinery and a water-driven concentrator of 100 tons capacity.——The stockholders of the Charles Dickens Mining Co. have no longer any interest in the property. The time allowed them for turning in their stock in the old company and receiving an equal number of shares in the Idaho-Knickerbocker Mines Co., in consideration of a payment of seven cents per share, has expired, and, as far as can be learned, in this district very few of the holders appear to have taken advantage of this offer. The only means by which the stockholders in the old company can regain the property, which was sold to A. D. Gritman under a sheriff's sale, would appear to be by means of a voluntary assessment to meet the indebtedness of the company to Mr. Gritman within one year. A meeting of the Idaho-Knickerbocker Co. has been called for next week, when the terms under which the new company will acquire the property from Mr. Gritman will be discussed.——A contract for 200 ft. of driving and cross-cutting has been let on the property of the Horn Silver Mining Co. It is expected that a depth of 400 ft. on the vein will be attained. It is the intention of the company to erect a concentrator in the spring, and nearly all of the funds necessary for this purpose have been secured.——Samples taken from the face of the drift in the 50-ft. level of the Josephine mine, on which a good strike of ore was recently made, and where the vein has been proved to be about 12 ft. wide, give returns of $66 per ton, made up as follows: gold, $1; silver, $4; copper, $18; and lead, $43. Machinery for further sinking has been ordered. It is also the intention of the management to drive a raise to the surface, a distance of 65 ft. on the dip of the vein.——It is believed that the Morning mine, the big producer of the Federal company in the Mullan district, is to be equipped with a hoist similar to that in use at the Hecla mine at Burke, which was installed last winter at a cost of about $50,000. Engineers of the Federal company have been examining the plant at the Hecla mine and gathering data on its work. The hoist has a capacity of 2400 ft. for a lift of three tons of ore on one trip, and is driven by electricity. The manufacturers are the Westinghouse Electric & Manufacturing Co. of Pittsburg and the Wellman-Seaver-Morgan Co., of Cleveland. ——According to statements issued by Morris H. Hayman and Edward Baer, of New York City, president and secretary, respectively, of the Golden Chest mine, in the Murray district, extensive improvements are to be made in that property this spring. It is the intention of the management to increase the capacity of the 20-stamp mill by the addition of another 30 stamps, and to install the necessary machinery for the extraction of tungsten. Advances have been made to the management for the tungsten output of the mine by both the United States Government and the Krupp steel works of Germany. It is believed that as much as $900 per ton can be gained from this ore. The company has also under consideration the advisability of installing a cyanide plant.——A large amount of machinery is about to be installed at the Butte & Coeur d'Alene mine, on which a big strike of ore was made some time ago. The new equipment will consist of a four-drill compressor, a compressed-air hoist, electric light plant, and other machinery. The company proposes to both sink and raise on the oreshoot and to make regular shipments of the ore extracted during development. J. E. Quinlan, of Mullan, is president. ——The estimated production of the Hecla mine at Burke for 1908 is 282,800 oz. silver and 9,928,130 lb. lead, as compared with 550,342 oz. silver and 19,024,893 lb. lead for 1907. The decrease for the present year is due to the fact that the mine was closed from January 1 to June 1. A force of men is now sinking a shaft from the 900 to the 1200-ft. level.——From two to four feet of ore carrying

gray copper, lead, and carbonates of iron has been exposed in the property of the Rainbow M. & M. Co. The adit has been driven about 550 ft., but 100 ft. more is necessary to get under the surface showing. The men in the lower workings have been taken to the surface and are engaged in the exploration of the upper workings.——The spring development of the Nipsic mine, operating the famous Father Lode claim, will include the letting of a contract for 100 ft. of work on the No. 3 level and the construction of a wagon road to Dobson's pass, together with a tramway to the railroad in Nine Mile canyon. A large quantity of ore is sacked and ready for shipment.——Active development has been resumed on the property of the Acme Mining Co., north of the Snowstorm mine. A contract for the continuation of the adit for 100 ft. has been let, and as soon as this has been completed another will be let.——The management of the Tucker M. & M. Co. has let a contract for 100 ft. of work to H. O. Dahl and others. The adit has been driven 450 ft., and it is believed that the present contract will be enough to tap the vein at an approximate depth of 350 ft. It is the intention to install a four-drill compressor in the early spring and to enlarge all the company's buildings, with a view to engaging a large force of men.——The Hecla mine at Burke has declared a dividend at the rate of three cents per share. This involves the distribution of $30,000, and is the 66th dividend paid by the company. A total of $190,000 has been paid this year, and a grand total of $1,710,000.——A dividend of 1½% has been declared on the common stock of the Federal Mining & Smelting Co. This is the first dividend on the common stock since this time last year. The total paid on the common stock since the incorporation of the company is $2,643,750, while on the $20,000,000 of preferred stock the company has disbursed this year $630,000, and a total in all of $3,934,250. It is believed that the declaration of this dividend has a considerable amount of significance for the stockholders of not only the Federal company itself, but for the stockholders of the American Smelters Securities Co. and the stockholders of the American Smelting & Refining Co. According to the rumors, the Securities company has not been earning its dividends, and has been forced to borrow from its parent. If this be so, the $45,000 which it will receive January 15 on Federal stock will help materially to cut this indebtedness. Should the Federal company be in a position to increase its common dividends, it will go far toward liquidating the entire amount. The Federal company has on hand about $1,000,000 in cash, practically all of which may be considered as working capital, the liabilities, with the exception of its stock, being only small current items.

Wallace, January 2.

NEVADA.

CHURCHILL COUNTY.

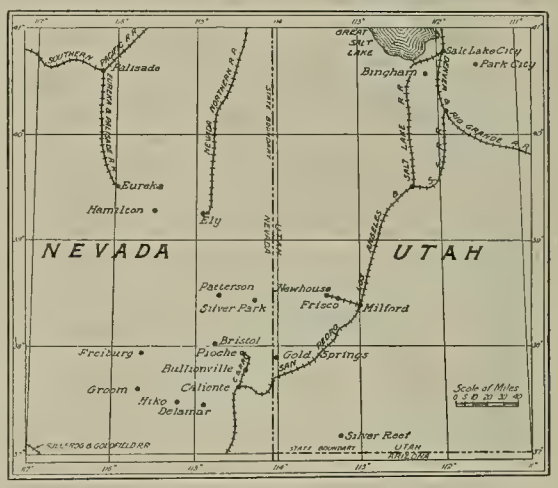
The sampler of the Western Ore Purchasing Co. at Hazen was destroyed by fire on the night of January 3. The blaze originated in the oil-burner used under the boilers. Insurance to the amount of $35,000 was carried on the plant. The business of the company will not be interrupted, as it owns the old Nevada Ore Sampling Works, at the same place, and that property will be used pending the re-building of the destroyed structure.

ESMERALDA COUNTY.

W. E. F. Deal, of San Francisco, has purchased, at Sheriff's sale, a group of mining properties at Candelaria, including the Holmes and Northern Belle. The consideration was $201,419. It is believed that the new ownership will mean a resumption of activities at this long abandoned camp.——More than half of the 100 stamps in the mill of the Consolidated company are now dropping regularly in the actual treatment of ore, and are working without a hitch. The number will be gradually increased until the entire battery is in operation, which it is believed will be accomplished early next week.——The Combined Mining & Leasing Co. has secured a new 18 months' lease on their old block of ground on the Velvet, beginning January 1, and work has been started in earnest once more, a contract having been let for 200 ft. of cross-cutting. The recent strike on the Ricker lease, adjoining the Combined lease on the west, has given a new impetus to the work.——A discovery of rich ore at a new camp called Wilson has caused a small stampede from Goldfield, Tonopah, and near-by camps. The find was made by J. W. Wilson, on a claim on which he had been doing the assessment work. Numerous leases have been granted and a townsite is being planned.——The re-organized Johnnie Consolidated, of which Al. D. Myers is president and general manager, started up its mill recently. Twelve out of the 16 stamps are now in operation, and the rest will be put in commission as soon as the machinery is all tested.

LINCOLN COUNTY.

The Milwaukee group of claims, near Pioche, has been bonded to William C. Alexander and his Indiana associates, and development work is to be started at once.——The Pioche X-Ray Co. has ordered a compressor-plant for use in driving the adit on its property in the Highland district. The bore has 400 ft. more to go before cutting the vein. J. W. Taylor is general manager.——The Metals Exploration



Eastern Nevada and Western Utah.

Co., which recently took over the Point mine of the Pioche-Nevada Consolidated Mining Co., has completed several new mine buildings, including a boarding-house, bunk-house, and office. A force of miners, under Thomas J. Hooper as superintendent, is driving both ways on the 65-ft. level, the purpose being to decide on the proper place in which to start the working shaft.——The Nevada-Des Moines has ordered a 40-hp. boiler and sinking pump and will resume sinking in its shaft at Pioche.——William M. Wantland, of Salt Lake, has purchased the Weston group of claims, which lies between the Pioche King and the Abe Lincoln, at Pioche. He will organize a company to work it at once.

WHITE PINE COUNTY.

The Giroux smelter, at Ely, was destroyed by fire the last week in December. The building is a total loss, while equipment was damaged but not destroyed. The plant was completed last summer, but was not blown in, and hence the loss does not interfere with the continuous operations of the Giroux property.——The construction of the third reverberatory furnace is progressing satisfactorily, and the fourth unit of the big plant will be completed by the time it is needed. The Veteran mines and the Giroux are employing all the men who apply for work, and all Ely mines are producing average outputs.——The Kohinur Mining Co. has been incorporated by C. E. Millick and associates, of Osceola, Nevada. The purpose of the company is to erect a mill and install a mining plant at its property just across the range east from the Nevada Consolidated smelter. The ore is said to average $17 per ton. It is reported that Portland, Oregon, capital is back of this enterprise.

Special Correspondence.

LONDON.

Venture Corporation. — Poderosa in Chile. — Developments on the Rand.—Public Indifference.—Consolidations.

One of the most interesting flotations of the year is the Poderosa Mining Co., Ltd., which has been formed to acquire the assets of a company of similar name registered in Chile. The present flotation is not so much for the purpose of buying out the present owners or raising new capital as for the purpose of transferring the proprietorship from Chile to England, and thus making a market for the shares. The mines are in the district of Collahuasi, Tarapaca, and have been connected by a new branch line with the Antofagasta railway. Developments were started in 1903 and regular shipments of ore began in January, 1908. To the end of October 17,256 tons of ore averaging 25% copper and 11 oz. silver per ton have been shipped. The profits for 1908 are estimated to have been sufficient to pay for the whole of the cost of machinery and plant and to pay £60,000 as dividends. The success that has attended the development of this mine is chiefly due to the mining and civil engineering skill of Robert Hawxhurst, Jr., who is well known in San Francisco.

Some important economic developments have been taking place in the Rand during the last six months or more, as has been mentioned from time to time by your Johannesburg correspondent. The curious part of it is that the news relating to these matters is not circulated to any great extent in London, and the interest taken in them seems to be mostly academic. The public in general is not attracted by any of these improvements in the conditions of Transvaal mining operations; this seems a pity, for there have been many more unattractive opportunities for getting a decent return on capital invested than the schemes put forward just at present. Briefly, these improvements have been caused by the plentiful supply of native labor to take the place of coolies, by the consolidation of organizations operating groups of mines, and by the lowering of working costs all round. Many low-grade properties that have been lying neglected for years are being taken in hand, and in many of the more developed or older properties it has been possible to count the blocks of hitherto useless low-grade ore as useful reserves. An example of the indifference of the public was the failure to float the consolidated company to take over the Randfontein group, but Sir Joseph Robinson, the controller, nothing daunted by the coolness of investors, has come forward with a million pounds wherewith to effect the organization.

I mentioned some months ago an example of the consolidation of the East Rand Proprietary and its subsidiaries. This week an equally important amalgamation has been announced by the Crown Reef people.

With regard to the raising of additional funds by mining companies during the past year, it is hardly necessary to say that the stress of circumstances has forced many of the controlling houses to remodel their views as to what expenditure should be charged to capital and what to revenue. It has been the orthodox rule in many quarters to issue new shares for new plants. Owing to the inability of shareholders recently to take up new shares, the issuing houses have had no alternative but to provide for these additional expenditures out of revenue.

In the domain of big public companies that undertake the promotion of mining enterprises, the most interesting event of the year has been the re-organization of the Venture Corporation. For eight years this company financed on a razor-edge, without issuing a report or calling a meeting of shareholders, in itself a truly wonderful performance; however, everything comes to an end at last, including the hidden troubles of this company, and accordingly a re-construction, with the subscription of new capital, was effected during the summer. Another interesting feature in the same connection is the broadening of its basis of operations by the Consolidated Gold Fields of South Africa. Originally intended for financing mines in the Transvaal, this company has in recent years gone farther afield. During the last few weeks it has been announced that the company is intending to put additional money into some of the West African mines, and accordingly general attention has once more been directed to that part of the world.

NEW YORK.

American Smelters.—Statement by Daniel Guggenheim.—New Competitive Company.—Anthracite Coal Reserves.—Newhouse Mines.

Recent events in New York mining circles are likely to have an important bearing upon the American copper industries. It will be remembered that, since the panic of 1907, the shares of the American Smelting & Refining Co. advanced on the New York Stock Exchange erratically. All kinds of rumors have been started by the news bureaus operating in the interests of powerful financiers, and many of Mr. Lawson's advertisements in the daily press have referred to them. The public has been led to believe that the control of the company passed from the Guggenheims to the Standard Oil group during the panic, and that it was to be annexed to the Amalgamated Copper Co. On the strength of these assertions the stock of American Smelters advanced. Early in December, however, the information was given out in Wall Street, that very few shares in the company are held in the names of either the Guggenheims or Rockefellers. Many shares are in the company's books in the names of Wall Street firms as trustees for the owners. The Standard Oil insiders were reported to have sold out their holdings in November. The result of these statements was a marked fall in the stock. Contemporaneously with this decline, the public was informed that the Standard Oil had again quarreled with the Guggenheims, and had determined to establish a rival concern, which would erect smelting plants wherever the American Smelting & Refining Co. has them.

A prominent news bureau, identified with Amalgamated Copper interests, gave out the following:

"The Rockefellers have sold out all of their holdings in the American Smelting & Refining Co., and have taken stock in a new combination. A smelters' war of big proportions appears imminent.

"The copper companies have been for years dissatisfied with the charges of the smelting monopoly, but the breaking point came about a year ago, when the Utah Consolidated Co. was unable to get a definite answer to a proposition to the Guggenheims for the renewal of its smelting contract. The Utah company then began the erection of an independent smelter, which will be ready for operation in the spring."

These statements were published by several of the New York dailies and aroused much comment in mining circles. The following day, Daniel Guggenheim, president of the American Smelting & Refining Co., issued the following statement:

"There is nothing new that I can see, or any change of policy, in the so-called Ryan-Cole development of the copper smelting business. The group of gentlemen known as the Ryan-Cole, and their following, have been for many years in the copper mining and copper smelting business. They are great believers, undoubtedly, in copper as a metal. So am I. They can see that a great deal of money can be made in this business, as can be when intelligently prosecuted.

"They have interests in copper smelters and copper mines in various parts of the United States, and properties in various parts of the world. It is a business they have gone into, and whether or not they have now formed a large company for the purpose of taking in other interests, or for the purpose of building new smelters and buying new mines, it is nothing new, nor is it anything that the American Smelting & Refining Co.'s shareholders need look upon with any concern whatsoever, because the American Smelting & Refining Co. has not a single exclusive copper smelter in the United States. They have a few copper furnaces at

some of their plants, which are simply used as auxiliary furnaces to provide for by-products and such ores as are contiguous to their locality.

"The American Smelters Securities Co. has only one exclusive copper smelter in the United States. Neither of these companies is likely to have in the near future any more exclusive copper smelters, because they look upon copper smelting as an extremely annoying business, and if one is fond of litigation and likes it as a steady diet I strongly recommend building a copper smelter in a farming locality.

"The American Smelting & Refining Co. is largely interested in copper refining. I personally am very fond of, and believe in, copper mining as a highly profitable business, and copper refining as a very satisfactory business; but I would not go into the copper commission smelting business or advise any companies with which I am connected to go into the copper smelting business unless to smelt the copper ores from their own mines. By that I mean I do not believe that the smelting of copper ores on commission for others is a business that, at present at least, is desirable. If one has copper mines and a smelter situated away from the farming district to treat the ores of those mines, this is an entirely different affair.

"As regards the lead-smelting business of the American Smelting & Refining Co.: Fully 90% of all the lead ores of the United States and in the Republic of Mexico are now controlled by ownership of mines and by long-time contracts. These ores are either controlled by the American Smelting & Refining Co. or by its present competitors. And I wish to state further that the earnings of the smelting company at the present time, as well as of the Securities company, are considerably in excess of the dividends that are being paid."

On December 21, a corporation, called the International Smelting & Refining Co., was registered under the laws of New Jersey, at Trenton, N. J. This company was incorporated with a capital of $50,000,000, and its object, as stated in the incorporation papers, was to engage in the business of mining, milling, and smelting ores.

While the above events were occurring, meetings were held in the offices of Phelps, Dodge & Co., in New York, and attended by representatives of all the large American and Mexican copper producing companies, including representatives of the Amalgamated and A. S. & R. companies, with a view to reaching an agreement for improving copper mining conditions. The results of these meetings are officially reported to have been satisfactory. While disclaiming any trust agreement, James Douglas, who presided at the meetings, stated that they were merely a repetition of a series called five years ago by the late John Stanton. All the prominent copper producers were asked to furnish their output-statistics, so that the amount of copper can be easily and properly ascertained at any time. This was agreed to by the producers, and in the future each company will be informed of the production of the others. This is the official account of the agreement reached.

There is a strong impression in mining circles, however, that within the past three months a powerful copper trust has been formed in New York by interests closely connected with the Standard Oil and the United States Steel corporations. The trust will practically control the mining and smelting of American and Mexican copper ores, as well as the leading concerns manufacturing copper goods. It promises to have a greater control of the copper industries than the United States Steel Corporation has of the steel industries. It appears probable that the International Smelting & Refining Co. will be used to manage the Trust. It will be found later, doubtless, that instead of the Rockefeller interests being at war with the Guggenheims, they have absorbed them, as they have absorbed many smaller producers. The copper market is not expected to feel the influence of the new combine until early in the summer months. The price of copper will then start to advance, and within two years high prices are predicted for the metal.

William Griffiths, a coal expert, in giving evidence at the Coal Trust hearing in Philadelphia last week, stated that he estimates the available supply of anthracite in the United States to be about 22,000,000,000 tons. The latest estimates made by M. R. Campbell for the United States Geological Survey were 21,000,000,000 tons. P. W. Shaeffer, in 1879, estimated the supply at 26,360,576,000 tons for anthracite, and 8,276,856,666 tons for steam coal in Pennsylvania. A study of these estimates will show that the question of the exhaustion of the coal beds will not interest the present generation. Other witnesses at the hearing testified that the railroad companies either directly or indirectly controlled 96% of the coal lands of Pennsylvania and adjacent State. Most of the land was acquired by purchase nearly forty years ago.

Robert S. Bradley, chairman of directors of the American Agricultural & Chemical Co., and David A. Ritchie, president of Lamb & Ritchie, sheet metal manufacturers, Cambridge, Mass., have been elected directors in the United States Smelting, Refining & Mining Co. It is officially stated that the earnings of the Newhouse Mines & Smelting Co. are not sufficient at present to justify the payment of dividends. The company is earning enough to pay its fixed charges, and a surplus which is going to the improvement account. There is a large amount of ore blocked out in the mine which can be profitably worked when copper again reaches 18 cents per pound. The present output is 800,000 lb. of copper monthly, but the plant now being erected will have a capacity of from 12,000,000 to 15,000,000 lb. of ore. It is estimated that the copper in the ore already blocked in the mine amounts to 2,000,000 lb. Stocks on hand amount to 200,000 lb. The Boston Consolidated mine is producing 3000 tons of ore daily. A new plant, which will increase the capacity 45%, is in course of erection. It will be completed in February, 1909.

Reports from Michigan state that there is at present no accumulation of copper in the Lake Superior district. Navigation is closed and the docks are quite cleared. Railroad shipments to New York and Boston have been commenced, and it is not proposed to allow any copper stocks to accumulate during the winter. The United States Circuit Court at Trenton, N. J., on December 19 dissolved the order to show cause for restraining the receivers of the Arizona Smelting Co. from the delivery of deeds for the property. Everything is now arranged for the receivers to convey the properties of the Arizona Smelting Co. and of the Consolidated Arizona Smelting Co. to a new corporation. Hooley, Learnard & Co., of the New York Stock Exchange, have been appointed reorganization managers. They announce that the reorganization plans contemplate the formation of a new company to acquire, subject to an existing indebtedness of $255,000, the properties purchased at the trustees' sale on November 10 last. The new company will issue 1,840,000 shares of stock of a par value of $5 each, and $1,200,000, 30-yr., 5% bonds, convertible at any time into stock at par. Each two shares of the old stock, on which an assessment of 50c. per share shall have been paid, will be exchangeable for one share of the new stock, and bonds at par to the amount of the assessment paid. Notes of the old company will be satisfied with 5% cash, 85 in stock, and 10 in bonds at par. The company would thus resume business free from debt and with cash on hand of approximately $797,775.

The Old Dominion Copper Mining Co. is expected to close the year 1908 with a December production of 4,000,000 lb. copper. Six furnaces have been running full time this month. The total production for the year is estimated at 38,000,000 lb. The directors of the American Zinc Co. propose issuing new debenture bonds, amounting to $5,000,000. All the shareholders on the company's books on December 22, between that date and January 1, 1909, will have the right to subscribe for the bonds in the proportion of one $1000 bond for each $4000 per value of stock held. Underwriters have agreed to take all the bonds not issued to stockholders in the company. The debentures are being issued to enable the company's plants to be enlarged.

MEXICO.

Review of Conditions in 1908.—Progress Under Difficulties. — New Enterprises in Chihuahua. — Operations in Sonora. — Cyanide Process at Zacatecas. — Smelting in Durango. — Guanajuato.

Quiet but not unsuccessful; thus may the condition of the mining and metallurgical industries of Mexico for the past twelve months briefly be summarized. As mining is nearly the most important basis of enterprise in the country, and decidedly so considered in its international aspects, the year 1908 did not open auspiciously for this Republic. The falling metal markets, the financial troubles in the United States, and practically the entire cessation of the inflow of foreign capital, did not promise a bright future. Added to the setback that would naturally occur was the threatened increase in freight rate of 10, 20, and 30%, respectively, on ores of a valuation under ₱25, from ₱25 to ₱50, and over ₱50 per ton, and though it has not yet gone into effect it has hung throughout the year like a black cloud over the head of the miner, who would have had to carry the burden. What that burden would amount to may be imagined when it is stated that a close estimate shows that 48% of the freight receipts of the Mexican railroads are from mining products and supplies. After six months of worry came the publication of the project for revision of the mining law, placing restrictions on foreign operators in Mexico. Though the greater part of the objectionable features were eliminated from the final draft of the law before presentation to Congress, the effect was to check new enterprises. A slight uneasiness was also felt by an increase in the tariff on iron and steel, and their manufactures, but of greater importance has been the recent move on the part of the railroads and the domestic coal producers, for an increased freight rate, or a protective tariff on imported coal and coke. This is still under consideration by the Government commission. From all sides, during the entire year, there has been a continual nagging at the heels of the miner. Though it has in truth been a quiet year, yet progress has been made, and about thirty of the principal companies have paid in dividends $8,500,000 gold on a total capitalization of $60,000,000. Perhaps the most marked progress has been in the State of Chihuahua. In the great old camp of Santa Eulalia the production has continued without interruption at the rate of 12,000 to 15,000 tons per month, and important discoveries have been reported from the Mina Vieja, the Velardeña, the Santander, and the San Toy group. In western Chihuahua the year has seen the completion of the mills and the placing on a good paying basis of the Republica and Rio de Plata companies, with an electric plant at the latter; the building of a large portion of the mill at the Lluvia de Oro, as well as its 500-kw. hydro-electric plant; and the enlargement of the mill and the completion of hydro-electric power plant for the Dolores Mines Co. All of these are using the cyanide process. Rich and important strikes have been made in Yoquivo and Uruachic. The total collapse of the Greene Gold-Silver Co. and its allied companies has been a serious detriment to the western part of Chihuahua, but some of the prospecting concessions held by the Greene company will expire early in January, and it is expected that many new people may be drawn to the district. East of the city of Chihuahua the Chihuahua Copper Co. is opening a large property in the Chorreros mountains; good zinc continues to be developed dear Picachos; and close to Presidio del Norte prospecting and development of the oilfields by Hearst and Keene has led to the organization of a large independent company reputed to have $10,000,000 capital, which will persist in the thorough prospecting of all eastern Chihuahua, where a large concession is held. Both eastern and western Chihuahua are greatly encouraged by the building of the Kansas City, Mexico & Orient railroad, which is spreading out in both directions as rapidly as its funds will permit. At Terrazas, about 30 miles north of the city of Chihuahua, the little old copper smelter of the Rio Tinto company, together with its mines, was taken over by Corrigan & McKinney, of Cleveland, Ohio, and the smelter has been almost wholly re-built and enlarged to a capacity of 300 tons per diem. It will be blown in early in January. Just outside of Chihuahua, at Morse, the new plant of the American Smelting & Refining Co. has been completed and three furnaces are in operation, being supplied principally with low-grade ores from the company's mines in Santa Eulalia. This plant is producing a carload of lead bullion per day. An aerial tramway is being erected by the A. S. & R. Co. for carrying ores from the mines to the Mineral railroad for transmission to the smelter. The Encinillas smelter, at Santa Rosalía, has undergone considerable alteration and addition, but still remains closed. In the Parral and Santa Barbara districts, the Tecolotes of the American Smelters Securities Co. has had a most successful year, treating 18,000 tons per month of the complex lead-zinc-iron sulphides in its re-constructed mill; El Rayo Mining & Milling Co. has been developed into a great property, and as it yields principally gold, it has not been materially affected by the metal prices; the San Francisco del Oro has given the flotation and the Sutton-Steele dry-table processes thorough tests, but without success, and the mill is now closed; the famous Palmillo of Pedro Alvarado, has been taken over by Boston capital under a 15-year lease, and will be systematically developed below water-level as soon as an adequate pumping plant may be installed. West of Parral, at Roncesvalles, a number of rich strikes were made.



The Esperanza Mill and Mine, El Oro.

In the State of Sonora affairs have been perhaps more quiet than in the other important mining States, owing to its principal producers being copper properties that have suffered from the unsatisfactory condition of the copper market. The Greene-Cananea, however, resumed operations in July with an almost entirely new smelting plant of 3000 tons daily capacity. This resumption was urged by the Federal Government, that aided the company by granting a concession for the free importation of fuel oil from Texas. At Nacozari, the Moctezuma company, controlled by Phelps, Dodge & Co., completed the 2000-ton concentrator in April, and the same is now in operation. The

Cumpas and the Belén mining companies have each established small copper smelters on their properties in the interior of Sonora. El Tigre (or the Lucky Tiger) has been developed into one of the largest gold mines in the Republic.

Zacatecas is to be congratulated on the signs of progress there. Frequent reference has been made in these letters to what has been done in the old camps of Guanajuato and Pachuca, and at El Oro, with the cyanide process. Attention has been called to similar possibilities with that process at Zacatecas, with its thousands of tons of low-grade dumps. To the El Bote Mining Co. may now be given the credit of being the pioneer in introducing into Zacatecas the cyanide process on a large scale, where it has replaced amalgamation and lixiviation. As was the case in Guanajuato and Pachuca, others will soon follow.

In the State of Durango the year has seen the completion of many improvements at the smelting plant of the Peñoles Mining Co., at Mapimí, and that of the American Smelters Securities Co. (leased to the American Smelting & Refining Co.) at Velardeña. Both are in operation. There also appears to be likelihood of the old Durango Iron & Steel Co., owning the famous iron mountain—El Cerro del Mercado—resuming operations, after a shut-down of some 8 years.

In Guanajuato some new properties have been opened, and additions and improvements have been made in the established mines and mills; and the efficiency of sliming and filtering has been proved at the Pastita, the San Francisco mill of the Guanajuato Consolidated M. & M. Co., raising the total extraction to about 97%. The same method has been adopted by several other companies. The mills now operating in the Guanajuato district have a total of 580 stamps and 13 tube-mills, and are treating 60,000 tons per month. In addition, there is an output of 12,000 tons per month of shipping ore. The total monthly production has a value of nearly ₱1,250,000. Among the most important works initiated in 1907 was the drainage tunnel, Porfirio Diaz, that has just been completed. The Mexican Central railroad is running its trains into Guanajuato, and the Mineral Belt railroad, while not completed, is furnishing a much needed railroad and switching service to many of the properties.

The State of Jalisco has made rapid strides in the western portion. Near Ayutla the Agua Blanca has been developed into an immense low-grade copper property, and has a 100-ton mill; in Ayutla the Carrizo Copper Co. has completed an 80-ton smelter and is ready for operation. At Etzatlan the Amparo Mining Co. has proved the success of cyanidation and is obtaining good returns from its ores. In the Hostotipaquillo district the largest success has been attained. Here at least a dozen different companies have pushed development work in all parts of this complex cross-veined system, and no failure is recorded. Late in the year the Marcus Daly Estate acquired claims in the district, and in the coming year aid will be given by the rapidly approaching Southern Pacific railroad between Guadalajara and Guaymas.

At El Oro, the Esperanza, Dos Estrellas, and El Oro continue their remarkable production, with a combined monthly profit of over $300,000 from 60,000 tons of ore. An English company is working on the Victoria in the hope of finding the vein lost in the adjoining Dos Estrellas workings.

Pachuca has added to the list of properties using the cyanide process, and the Real del Monte, the pioneer in using cyanide in that district, declared its first dividend of $100 per share on 2550 shares in March.

In Oaxaca the smelting situation has not improved, and both plants are idle. Important prospecting is being carried on by the Oaxaca Coal & Iron Co. with promise of success. A number of the important mines have had a good year, others have resumed operation, and at the Ocotes mine of the Tezuitlan Copper Co., extensive development has opened large orebodies. The smelting plant of the latter company at Tezuitlan, in Puebla, has been closed down since November, 1907, for the purpose of enlargement.

KALGOORLIE, WESTERN AUSTRALIA.

Renewed Labor Troubles.—Discoveries on the Golden Mile. —Perseverance and Kalgurli Developments.—Great Boulder Reserves.

It would seem as if we were to have a repetition of the recent trouble with the firewood employees. So far, about 500 men are on strike from the Kurrawang Firewood Co., demanding more money for handling the fuel. The great trouble is that nearly all the workers are foreigners, and early this week they adopted a menacing attitude, necessitating the despatch of a posse of mounted and foot police to protect loyal workers and the property. At this writing, the position of affairs is far from being quiet.

The past month has been characterized by many good developments, and a buoyant share-market has resulted. Among the group of small mines at the south end of the 'Golden Mile'—the Boulder Main Reef, Chaffers, and Hannan's Star—much interest has been taken. Parties of tributors some time ago opened good ore in the Chaffers lease, and continue to get returns up to $60 per ton. The Hannan's Star also cut the continuation of this lode, and conditions in the Boulder Main Reef are rather encouraging.

In the Perseverance mine, at 1750 ft., high-grade telluride ore was found early in the month, and there was an unseemly rush to get shares, which appreciated considerably. So far, however, the output has not risen at all. The Kalgurli found good ore in new ground at the 100-ft. level, and at 1500 ft. in the Horseshoe the east branch of No. 2 lode was cut, being 5 ft. wide with $5 assays.

The ore reserves in the Great Boulder are now estimated at 701,165 tons, worth $17 per ton, this being an increase of 50,000 tons since the end of 1907. Another ball-mill is at work in the Great Boulder plant, this making 4 No. 8 Krupp and 12 Griffin mills; following these are 12 Edwards' tilting type, 2 Edwards' duplex, and 8 Merton roasting furnaces, 22 grinding-pans, 18 ordinary agitators for treatment of the mill-pulp, 13 filter-presses, and 10 Ridgway vacuum machines. The re-treatment of the old dumps by mixing, agitation, and filter-pressing, at the rate of 11,000 tons monthly, has been suspended of late, owing to some metallurgical difficulty experienced in the largest of the tailing heaps.

The October returns were as follows:

Name.	Tonnage.	Output.	Profit.	Dividend.
Associated Gold Mines	10,437	$112,000	$ 40,000	.....
Associated Northern ...	3,760	38,500	14,000	.....
Golden Horseshoe	24,657	270,000	100,000	.....
Golden Ridge	2,220	27,000	13,000	.....
Great Boulder Perseverance	18,037	135,000	32,000	.....
Great Boulder Proprietary	16,806	248,000	130,000	.....
Great Fingall	22,240	135,000	20,000	$155,000
Hainault	6,056	31,000	2,500	.....
Ivanhoe Gold Corporation	19,618	215,000	105,000	250,000
Kalgurli	10,945	150,000	82,000	185,000
South Kalgurli	9,031	62,000	12,000	.....
Lake View Consols	7,846	60,000	10,000	.....
Oroya-Brownhill	11,512	80,000	11,000	112,000
Oroya Black Range....	4,472	55,000	20,000	.....
Sons of Gwalia	13,401	92,000	27,000	.....
Sons of Gwalia South..	1,995	22,000	750	.....

GUANAJUATO, MEXICO.

La Luz. — Guanajuato Development. —1000-Ton Mill Projected.—Guanajuato Amalgamated. — San Cayetano Mines. — Benito Juarez.—Dos Estrellas.—San Rafael Mill, Pachuca.

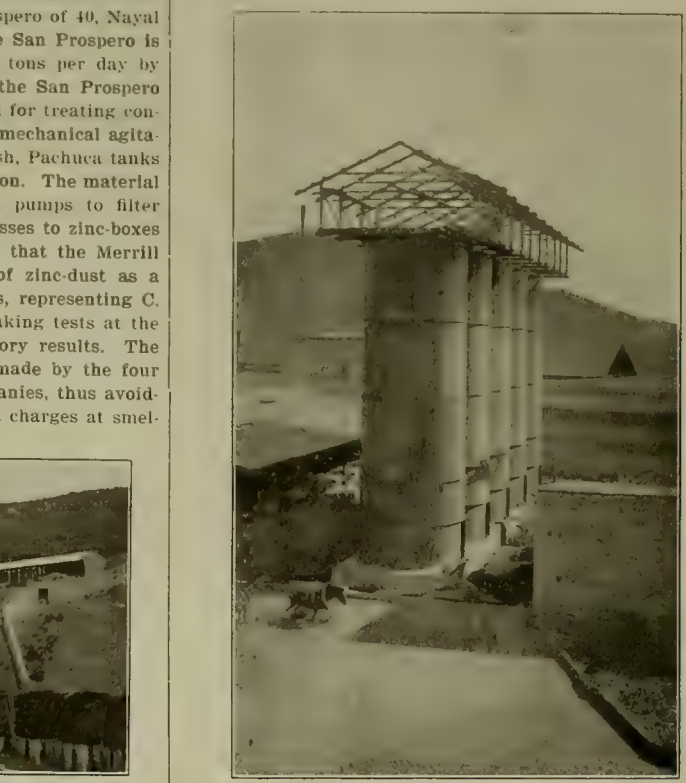
La Luz district, 10 miles southwesterly from Guanajuato, is attracting attention by reason of present and prospective operations and the building of the La Luz branch railroad by the Mexican Milling & Transportation Co. This is one of the subsidiaries of the Guanajuato Development Co., that also plans a main line from the Central yards at Guanajuato to the Pinguico, Peregrina, and Santa Rosa mines.

The La Luz branch is in course of construction. It starts from the Central yards and passes close to the San Prospero mill, winds over the hills above the San Cayetano to the Bolañitas group at La Luz, making a line 14 miles long. The track will cross the Santa Ana river over a dam that is to be constructed athwart that stream. The allied companies of the Guanajuato Development Co. have five mills in operation in the district, comprising the Pinguico of 40 stamps, the Peregrina of 100, the San Prospero of 40, Nayal of 20, and the Central of 15 stamps. The San Prospero is operated as a custom plant, treating 150 tons per day by concentration and cyanidation. Close to the San Prospero is the same company's new plant, designed for treating concentrate by cyanidation. It has tanks for mechanical agitation, tube-mills which pulverize to 200 mesh, Pachuca tanks in which agitation occurs in cyanide solution. The material from the latter is forced by centrifugal pumps to filter presses, and through these the solution passes to zinc-boxes in the precipitation room. It is probable that the Merrill precipitation presses, involving the use of zinc-dust as a precipitant, may be installed. L. D. Mills, representing C. W. Merrill of San Francisco, has been making tests at the San Prospero plant, and reports satisfactory results. The new plant is to cyanide the concentrate made by the four or five other mills of the subsidiary companies, thus avoiding the expense of shipping and treatment charges at smelters. One of the main purposes of Mr. Mills is to aid in determining the methods to be employed in the proposed 1000-ton mill, which is one of the projects under consideration by the Mexican Milling & Transportation Co. This milling project is closely allied to the district railroad scheme of the company, the intention being to haul the ores of Pinguico, Peregrina, Santa Rosa, La Luz, and other widely separated mines to a central milling plant which can treat them at a low cost per ton. The low price of silver and the predominance of that metal in these ores make it essential to reduce costs to the minimum. The La Luz ore, however, is proportionally higher in gold than most other ores of the district. One point claimed by those who would use zinc-dust and Merrill presses is that the cost of zinc would thus be reduced one-half and the time required for precipitation would be much shortened.



San Rafael Mill, Pachuca.

The Guanajuato Amalgamated Mines Co. is working the La Luz and Plateros veins, near the town of La Luz. It has a main shaft 185 metres deep, surmounted by a modern electric hoist. A level runs 100 metres from the bottom of this shaft to the top of an inclined shaft which extends 200 metres from that level on the dip of the vein. An electric hoist is installed at the incline. There are working levels from the 100, 145, 185, and 250-metre stations, most of the ore coming from the lower levels. The ore is hoisted in cars and dumped into bins at the mill. Here are three Gates crushers which reduce the ore to $\frac{3}{4}$-in. size before it is carried by belt-conevyor to the battery-bins. There are 100 stamps of 1050 lb. each, installed in two rows, back-to-back. The capacity is 300 tons per day through 40-mesh screens. Amalgamating plates have been discarded and the pulp now passes from the batteries to three Dorr classifiers; the sand from these passes to 10 Wilfley tables, the tailing from the latter being re-concentrated on another group of 10 Wilfley tables. The concentrate thus made contains 38% iron, and assays ₱120 silver and ₱350 gold per ton, the concentration ratio being 45 to 1. The final table-tailing passes to sand tanks, in which it is cyanided by a 0.5% KCy solution, with an average treatment of 12 days. Before passing to the sand tanks, however, this tailing goes to sand collectors with rim overflow, the slime discharging to settling cones and then to the slime plant. The slime from the Dorr classifiers passes to de-watering cones, dividing it into 4 parts of water to 1 part of thickened slime. This is charged to conical-bottomed treatment tanks, and is given air-agitation.



Brown-Pachuca Tanks, La Union Mill.



Mill of Mexico Mines of El Oro.

From these the solution is decanted and passed to the zinc-boxes. A 90-leaf Butters filter-press has been purchased and will soon be installed to treat the solution from the slime plant after agitation. The plant has 26 sand-tanks, each of 90 tons capacity, and 20 slime-tanks, each of 15 tons capacity. The sand-tanks are filled by belt-conveyors and discharged into cars by hand-shoveling. The ore has a siliceous gangue, but with a small percentage of lime. C. A. Lantz is mill superintendent, with Wm. Northgraves as superintendent of the mine. The water for mill-work is pumped two miles through a 5-in. pipe to a reservoir above the mill, making an ascent of 600 ft. in two miles. Lawrence Adams is general manager of the property.

The San Cayetano Mines, Ltd., controlled by New York people, and locally managed by F. H. Clark, has the group of mining properties between Guanajuato and La Luz which formerly belonged to the Mexican Mines Association of London. The former owners drove a level three kilometres long on the San Antonio vein, starting in a deep gulch where the old mill and other buildings are situated, and running toward La Luz. This level opened bonanza ore in the early days, and it is claimed that the present management has opened orebodies on the same vein by adits driven from higher points. The ore assays 350 grams silver and 5 gm. gold. The most interesting work now in progress is that of making a raise of 100 metres from the old adit level, 3 kilometres from the portal, to unwater the workings of the Mexia Mora, San Pedro, and Purisima mines. The first named belongs to the San Cayetano and the last two belong to the Guanajuato Reduction & Mines Co. By raising 20 metres farther a connection will be made that will drain all these old workings through the San Cayetano adit. They are embarrassed by caving ground and the work is dangerous.

The Benito Juarez Mines Co., in the State of San Luis Potosí, operating at Piñon Blanco, 10 miles south of Salinas station, has sunk its Eduwigis shaft to a depth of 500 ft. By driving a cross-cut 18 metres from the bottom a strong flow of water was opened, making the installation of pumps necessary before doing any further work. Triplex Aldrich electric pumps made at Allentown, Pa., are now being installed; these will be electrically operated. The mine-water is to be used in the mill. A new 75-hp. double-drum electric hoist has been erected. The mill will be ready for business by January 15. It has 20 stamps, of 1050 lb. each, to have a 7-in. drop, 102 drops per minute. The screens are 30 mesh, and the crushing will be in a weak cyanide solution. Following the batteries are cone-classifiers, Wilfley tables, and an Allis-Chalmers tube-mill. The pulp from the tube-mill will be passed through a Dorr classifier to separate sand from slime, the sand passing to leaching tanks and the slime to cone-bottomed agitating-tanks. The ore is said to be mainly gold, the bullion containing only 30% silver. The gold is free, but is in finely divided particles, and the silver is present as bromide. At the greatest depth, however, the silver exists as sulphide. The gangue consists of quartz and calcite. John C. Brennon and E. P. Ryan are directing the work. The company has installed an electric power plant at Salinas, the generators being run by steam-power, oil being used as the fuel under the boilers.

The Cia. Minera las Dos Estrellas, at El Oro, for the first eleven months of 1908, treated 144,413 metric tons of ore at its No. 1 mill, and 166,532 metric tons at its No. 2 mill. The production of mill No. 1 was 1,504.850 kg. of gold and 15,119.513 kg. of silver; that of mill No. 2 was 1,674,963 kg. of gold and 11,059.785 kg. of silver. The gold production of both mills yielded ₱4,292,747, and the silver was valued at ₱785,378, making a total of ₱5,078,126 for the eleven months ending November 30. Mill No. 1 is the old plant, which has 130 stamps; the new plant has 120 stamps.

The Esperanza's oxidized ore comes from the San Rafael vein and its numerous branches. The sulphide ore comes frem a vein parallel to the San Rafael, occurring in the slate hanging wall of the latter. The oxidized ore contains about 90% silica, 3 to 4% iron, and carries ½ oz. gold and 3 oz. silver per ton. The sulphide vein has a width of 5 to 30 ft., the ore assaying 2 to 6 oz. gold and 20 to 50 oz. silver per ton. The oxide and sulphide ores are milled separately, the former passing from the stamp batteries to the cyanide plant, in which the sand and slime are treated separately; the sulphide ore goes from the batteries to Huntington mills, thence to Wilfley tables, making a high-grade concentrate that is shipped to the Aguascalientes smelter, the table-tailing being cyanided. The plant is treating 120 tons per day of the sulphide ore and 300 tons of the oxide. This relates to the work of the old plant; but a new cyanide plant is being erected and important changes are being made which will result in discarding all of the old plant except the batteries, Huntington mills, and Wilfley tables. Concrete blocks are to be built under the stamp batteries, Huntington mills and concentrating tables, all of which will be accomplished without entirely shutting down. The new cyanide plant, under construction, will have 10 Krupp tube-mills, 12 Pachuca agitating tanks, 15 ft. diam. by 45 ft. deep; three Merrill presses for fine sand and two for the slime; and two Merrill precipitating presses. The new plant is situated on a site considerably lower than the old mill-dump. The dump contains half a million tons of material, and the intention is to treat the sulphide and oxidized ores as they come from the mine, and add to them about 300 tons per day from the mill-dump. The new plant, including the re-constructed part of the old mill, will be ready for operation next May.

The north shaft of the mine is 1440 ft. deep. It is sunk in the foot-wall of the San Rafael vein, and is being equipped with new skips. This shaft will be used exclusively for hoisting ore from all the veins; the south shaft, 990 ft. deep, will be used for men and timbers. The operating staff consists of Cortlandt E. Palmer, consulting engineer; Charles Hoyle, general manager; R. A. Conrads, assistant manager; D. L. H. Forbes, superintendent of construction; P. A. Herivel, mill superintendent.

In melting the precipitate at the El Oro plant crucibles of new design will be tried. They are made of graphite, and will have double the capacity of the No. 400 that has been in use. The new type is 29½ in. high, 22 in. diam. at the top, 18¼ in. diam. at the bottom, and 25½ in. at the middle. In the same mill they are using lumps of quartz in the tube-mills instead of the imported pebbles. The 9 tube-mills require 25 tons of this quartz per day, the consumption of the pebbles having been 6 tons per day. The use of the hard quartz instead of the pebbles effects an important reduction in expenses of operating.

The San Rafael mill at Pachuca is about complete, and it is expected to be in operation in January. It is equipped with 60 stamps, 40 of which weigh 900 lb. and twenty 1250 lb. The ore is crushed through a 20-mesh No. 28 wire screen, in a weak cyanide solution, the pulp passing to classifying cones, the coarse product going to Wilfley tables and the fine to pulp-thickeners. The table-tailing is classified in Dorr machines; the sand from the latter, after being pulverized to 200-mesh in tube-mills, goes to the agitating-tanks, which also receive the slime from the Dorr thickeners. The agitating tanks in this mill are the Pachuca tanks (Brown patent), cone-bottomed, air-lift style, giving continuous agitation and circulation of the pulp, affording aeration at the same time. The pulp after agitation is transferred partly by gravity and partly by pumping to 3 pulp-storage tanks, in which it is kept from settling and packing by slow-moving mechanical agitators, which also at the same time provide an even flowing pulp for the Moore filter-tanks. The Moore filter installation consists of two independent units of 100 leaves each. The capacity of the mill is about 300 tons of ore daily. Zinc shavings are used for precipitation. Edmundo Girault is manager of the San Rafael mine and mill; J. B. Empson, lately of Guanajuato, is consulting metallurgist. The ore and dump material to be milled will average about 700 gm. silver and 2 gm. gold per ton. The concentrate and high-grade ore will be shipped to one of the Monterrey smelters. The mine paid dividends of ₱1,000,000 in 1907 from high-grade ore that was shipped.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Gold-saving on the dredges at Oroville, under the best conditions, is estimated to reach 85 per cent.

In dredging, labor usually represents less than 40% of the total operating cost; where power is high, the proportion declines to 30%. In ordinary mining, labor constitutes from 55 to 60% of the entire cost of winning the gold.

Prospecting in frozen ground that is shallow is done with a single 'steam-point'. The ground around the 'point' will thaw sufficiently to permit the prospector to sink a hole 3 ft. diam. with a short-handle shovel to a depth of 15 or 16 feet.

To separate iron from manganese pyridine may be added to $FeCl_3$ solution containing free HCl, which precipitates the $Fe_2(OH)_6$ completely. Mn under these conditions will not readily oxidize so as to be precipitated. Ni and Co are not precipitated. Al, Cr, and Zn are only imperfectly precipitated.

The Great Boulder Proprietary, the deepest mine at Kalgoorlie, Western Australia, is now 2350 ft. deep. On the 2250-ft. level a lode 5 ft. wide is yielding 29 dwt. gold per ton, the total working cost being a little over 5 dwt., or 20 shillings per ton. Three-ton skips are in use on the main or Edwards shaft, which is vertical.

Radium emanation 'degrades' copper into lithium when the copper is in solution, and perhaps causes the 'degradation' of copper even into potassium and sodium. This was ascertained by Sir William Ramsay. The likelihood of some similar action of radium on gold was freely expressed a few months ago. It now appears that it is easy to exaggerate the transmuting power of radium. E. P. Perman announces that radium bromide will not convert the one-hundred millionth part of its weight of copper into lithium per day when acting under the most favorable conditions, and similarly that it will not convert the one two-hundred millionth part of its weight of gold into lithium per day. No fresh proof has been adduced that any 'degradation' at all is effected by radium.

Elevators for raising wet pulp, such as the tailing from stamp-mills, can be run at a belt speed of 9 ft. per second, and satisfactory results can be obtained at 4 ft. per second. The higher the speed, the better the discharge from the top, but the more strain upon the belt and buckets, if the material is scooped from the boot, so that with the high speed it becomes desirable that as much material as possible be delivered into the buckets, instead of into the boot. A good inclination for a belt of this type is 22° from the vertical. Both head and tail sheaves should be large, the former so that there is more grip on the pulley and less liability to slip, the latter so that the surface of the pulp in the boot may be a good distance away from the bearings. In estimating the capacity of an elevator, it is not safe to count on the buckets carrying more than one-third their full capacity.

In adjusting surveying instruments be careful not to strain the screws. It is a mistake to imagine that an instrument remains in adjustment longer if the screws be tightened beyond the point required for a snug fit. In this connection it may be well to remember that the adjustments should not be changed more frequently than is absolutely necessary. It is better to manipulate the instrument so as to eliminate slight errors of adjustment than to depend entirely upon correct relations of the fundamental lines. Test the instrument frequently for accuracy of adjustments, but before changing the screws determine precisely, by repeated trial, the amount of error, and remember that an instrument is rarely in absolute adjustment throughout. The same precaution as to straining should be observed regarding leveling screws. If one pair turns too hard, loosen the other pair, and never tighten the foot-screws so much that they can not be easily turned.

Lands below the line of ordinary high tide are not 'public lands' in the sense that they may be located under the placer mining laws, with the exception of such lands in a portion of Alaska. For Alaska, Congress passed a special act that provides for mining beach or tide-lands. By the common law, the title and dominion of all the lands below high-water mark were vested in the King. The common law of England upon this subject became the law of this country, except as modified by subsequent State or Federal enactment. The Supreme Court of the United States has decided many times that the title and dominion of the tide-waters and the lands under them, bordering on its territories, are held by the United States for the benefit of the whole people and "in trust for the future States." Upon the admission of any State into the Union, absolute property in, and dominion and sovereignty over, all soils under the tide-waters bordering such State, passed to it, with the consequent right to dispose of the title to any part of said soils, in such manner as it might deem proper, subject only to the paramount right of navigation over such waters, which is under the control of the Federal Government. This question of ownership of lands below the line of high tide has arisen in California in connection with boring for oil in the ocean off the coast of Santa Barbara county. The State Supreme Court held that an owner of land abutting on the ocean, could prevent interference with his right of access to the ocean, by the acquisition of tide-lands beyond. The Secretary of War had granted a so-called permit, as was done in the early history of Nome, Alaska, but the Court held that "this at most was only a statement that, so far as the War Department was concerned, it would make no objection if navigation was not interfered with." Of course, as to lands bordering on the ocean above high-water mark, and which are still a part of the public domain, title may be acquired under the placer mining laws, provided such lands are valuable for the mineral they contain.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Metric Equivalents.

The Editor:

Sir—Referring to a discrepancy between the equivalent of the metre in English measure, as given on pages 225 and 233, respectively, of our 'Civil Engineer's Pocket-Book':

On page 225 the value is given as.....	3.280869 ft.
On page 223 the value is given as.....	3.28083 ft.
Difference	0.000039 ft.

Concerning this, I quote as follows from page 217: "The determination of the equivalent of the metre in English measure is a very difficult matter. . . . The United States Coast Survey (Appendix No. 22 to Report of 1876, p. 6) adopts, as the length of the metre, at 62° Fahrenheit, the value determined by Capt. A. R. Clarke and Col. Sir Henry James at the office of the British Ordnance Survey, in 1866, namely, 39.370432 in. (=3.2808666+ ft. =1.0936222+ yd.); but the lawful equivalent, established by Congress, is 39.37 in. (= 3.28083 ft. = 1.093611 yd.). This value is as accurate as any that can be deduced from existing data."

In preparing our conversion tables (which include p. 233), we took, as a basis, the 'lawful equivalent', 39.37 in. = 3.28083 ft.; (See table A, 'Fundamental Equivalents', p. 230). The table on p. 225 is an older one, based upon other determinations. The difference, between the two values, 0.000039 ft., = 0.000468 in., is apparently well within the inevitable differences in determination of such a matter, so that both values may be said to be right, and either one of them, so far as we know, as nearly right as the other. It seems to us, therefore, that, in view of the explanation quoted above from p. 217, it is scarcely worth while to make a change in either value as printed.

JOHN C. TRAUTWINE, JR.

Philadelphia, December 9.

The Engineer as a Financier.

The Editor:

Sir—On my return to New York, after an absence of practically three months, I have looked over some of the copies of your paper which I had not seen during my absence, and note with interest your copy of October 17, containing Mr. Hammond's speech as President of the Institute, and your editorial comment thereon.

This speech of Mr. Hammond's, together with your own opinion on the subject, contain the first public expressions by engineers of prominence on the subjects that the Mining and Metallurgical Society of America proposes to discuss, with a view to arriving at the real views of representative mining engineers upon these subjects, and while the Society has not reached the point of actually taking up the matters discussed by Mr. Hammond and yourself, I believe a large number of the members are preparing themselves for such a discussion.

Candidly, I think Mr. Hammond has rather the better of the argument. He takes a view that a mining engineer's work is essentially commercial work, and that its value is simply commercial. He seems to assume that a man's standing in the profession is not to be determined by anything except his personal character, and in this respect his standing as a professional man is gained, in the same way that his standing as any other kind of a man would be gained; that the value of his work is a question of the value of such work to his clients, who may or may not be able to judge his technical qualifications.

In your editorial, on the other hand, you let the inference be made that a man's work as a professional engineer should be quite divorced from his ideas as a business or financial man. It seems hardly probable that you really intended such a meaning. Let us take for example an outline of a purely technical report on a coal mine. Mr. Smith, engineer, might say something as follows: "I have examined Mr. Jones' farm of 160 acres in Washington county, Pennsylvania. I find such and such openings and such and such drill-holes. I estimate that the coal seam on the farm will average 5 ft. 9¾ in. thick, and that the average analysis of the coal is 60% fixed carbon and 10% ash, etc.," with various elaborations and statements of the same kind. Now let me ask what use is such a report to the average business man, whether he is a technical coal man or not.

Let us then suppose that Mr. Brown, another engineer, gets the same information as Mr. Smith, and adds to it his knowledge of business and makes a report that reads something as follows: "Jones' farm of 160 acres can be depended on, in my judgment, to produce a million tons of coal, which can be mined for $1 per ton and can be sold for $1.25 per ton. It can be worked out in 10 years, at a total profit of $250,000. I figure its present value at $125,000."

As I take it, Mr. Hammond believes that a competent engineer should be able to make the latter kind of a report, and I agree with him.

As to an engineer investing in stocks or speculating in them, it seems to me that his activities in that direction should be no more limited than those of any other man of common sense. As an index of his character, his investments show nothing except by their success or failure, and by their nature. If an engineer trades on margins and makes or loses his money in that way, he should be classed as a gambler, just as any other citizen would be. If he is successful, he is a good gambler; if he is unsuccessful, a poor one; and one's confidence in him would necessarily be effected by one's estimate of him as a gambler, just as much as on his accomplishments as an engineer. As a matter of fact, a man of ability and stability is a composite character, neither abnormally reckless nor abnormally conservative, not altogether a gambler and not altogether unwilling to take legitimate risks. One can never find out what risks are legitimate and what are not legitimate until he stu-

dies the subject and gains his ideas from experience. Speaking as a man of very moderate success and attainments, I should say that the average engineer should be encouraged to invest his money and take his chances in his own line of business, rather than to keep out of it. I did not buy a share of stock in mining companies until I had been ten years out of college. Now, I think I should have made some investment of that kind the first year I was out. I should probably have lost my money, but I could do that just as well and better with $100 when I was 20 than I could with $1000 when I was 30, and a man must gain his experience somehow. He must have his attention called to necessary facts and conditions in such a way that he will give them the attention that they require, and it is seldom indeed that a man gives matters real attention until he deals with actualities. A man with natural bent for financial affairs cannot be kept from making financial ventures by any code of ethics, whether he is an engineer or not, but the man who is an engineer and who deals with financial questions should have some experience as a financier, or else he must be content to let other people draw all the business conclusions that his work warrants, and he must pay them to do it. The way he pays them is by getting less money for his services.

There is no business that is free from speculation and risk. The farmer is just as much of a gambler as any other kind of a business man. The only thing he is sure of is that he owns his land. Every year he takes his chances on a dozen different dangers that may destroy his crops; the conservative farmer, in order to hedge on some of his risks, plants a variety of crops, hoping that the enemy that destroys one may not reach the others. Mining too has its great speculative features, but they are of a different kind—fundamentally different. The miner gambles a certain amount of his money on his ability to find ore, but if the ore is there, it is not subject to any vagaries of the weather—it is always there—and for getting it out and making a profit on it he depends on conditions much more stable than those with which the farmer deals. The mining engineer, to be really competent, must face and master these facts. He is a very poor one if he does not.

I should not like to see it written in any code of ethics, or understood in any unwritten code, that a mining engineer should not be free to take a contingent fee. Granting that the doctor who makes a business of advertising that he will take pay only when he makes a cure, is a quack; and that the lawyer whose business is to take small cases on contingent fees, is apt to be a blackmailer and a shyster; and that the mining engineer who makes a business of reporting on properties to get paid only in the event of a sale, is apt to be a crook, we must nevertheless admit that these persons are so adjudged only because they undertake habitually what to an honest man would be an exceptional occurrence. I would not blame the doctor for wishing to get paid if his patient could afford to pay him but might not be able to pay unless he were cured; nor would I blame a lawyer for interesting himself in a case for which his client might not adequately be able to pay him unless he won; nor would I absolutely prohibit a mining engineer from taking his pay in shares of a property whose owners might not be able adequately to pay him in any other way and at the same time take care of their requirements. Nevertheless, this circumstance can only be an occasional one, and one's character is a guarantee whether the proceeding is honest or dishonest.

Now, regarding the duties of a mining engineer in the case of apex litigation, it seems evident that this is a case made important, not by the character of the profession, but by the character of the laws. Of course, the laws are absurd; but on that account it is not any more desirable that honest and competent men should leave their clients to deal with dishonest and incompetent men. It would indeed be better that expert witnesses should be appointed impartially by the Court, but that provision has not been made by the law, and it is not the custom; therefore the mining engineer must do the best he can. Since the basic principle on which these cases are fought is a wrong one, and an absurd one, it cannot be denied that thousands of mistakes and inaccuraries have been made in trying to make the best of it. It often happens that the competent man is led, after a week's investigation, to give his opinion on questions that might legitimately take him a year to answer, but he may not be aware of the fact, and makes blunders innocently.

The principal thing to be insisted upon in this connection, as in any other connection, is that a man should try to tell the truth, and should try to secure time for making a proper investigation as to what the truth is.

J. R. FINLAY.

New York, December 15.

Smelter Smoke.

The Editor:

Sir—The editorial in your issue of December 19 on 'Smelter Smoke' is exceedingly timely, and should be spread, not only among the mining people, who are naturally your subscribers, but also among the farming communities adjoining the smelting centres, to endeavor to enlighten them on the subject, which they now can view only through the distorted lens of their own selfish interests. The case that lately arose between the Federal Government and the Washoe smelter seems particularly aggravated, in as much as the matter has been heard by a Master in Chancery, and by him reported to the U. S. Court, and a provisional finding in favor of the smelting company made. In this hearing it was shown that the damage done is now small and not, as stated, irremediable, and it may readily be adjusted by appraisement. It is well known that the Washoe plant has put in operation one of the largest dust-chambers, smoke-flues, and chimneys in existence, and that from this they take large amounts of arsenic, letting practically none escape. At the plant of this same company at Great Falls, Montana, similar improvements, costing nearly a million dollars, are now being completed. These evidences of good faith

in the desire to abate possible nuisance should weigh heavily in the balance against mere statements of damage, past and future.

As for the irremediable damage from the smoke and fume, I would like to call your attention to the country around the old copper smelting plant at Spenceville, where several hundred thousand tons of pyritic ore were roasted in heaps. This method is well known as being the most deadly to the surrounding vegetation, yet today, after the lapse of about 12 or 14 years, there is no sign on the surrounding hills of the former de-forestation.

Unfortunately, the entire trend of modern smelter-construction has been toward the concentration of all the gases, from roasting, reverberatory, and blast-furnaces, into one great flue and stack, instead of into several stacks, as in the older practice. This one great modern stack therefore emits a vast volume of gases, of greater concentration, and this, driven by shifting winds, and owing to its great density not being readily dispersed by them, descends like a flail and lays low the vegetation on the particular spot which it touches. In the older plants the sulphurous gases were delivered into the atmosphere at lesser altitudes, but through the orifices of many stacks, and therefore in more dilute form; therefore the effect on the country surrounding the plant could not be as deadly as that from the big stack.

In Utah the copper smelting plants have been closed down by injunctions of court, and two at least will not be re-opened at the old locations; I believe this situation might have been relieved by the installation of the roasting furnaces near the mines, either in Bingham canyon itself or on the bench just outside the canyon; in either case the gases from the roasting of the ores would have been delivered into the air at an elevation of 1800 ft. above the valley, and at a distance of 10 miles or more from it, and would have been harmless. This roasting operation would have removed four-fifths of the sulphur. As an offset to this operation the fact is well known that the smelting of cold roasted material is a much more expensive process than if the same material is transported to the smelting furnace while yet hot from the roasters. The financial equation can be readily calculated, for the respective properties, taking into account the erection of the necessary new roasting plant, as against the re-erection of the entire works at some new point. The works of the Tennessee Copper Co., and of the Mountain Copper Co., have each been equipped with a sulphuric acid manufacturing plant, and the product will be made serviceable in the shape of phosphates. Each of these plants is so situated that it has access to the market for these products, and also has readily available the crude phosphates from which they are made, but these conditions do not exist in most localities where the smelting industry is now established, and the freights on both products would be in many cases prohibitive.

The lead smelting plant of the United States company at Bingham Junction has recently been equipped with a bag-house, and in conjunction with this a patented method of neutralizing the sulphurous acid by means of zinc-oxide has been installed; this is said to be cheap and efficient, but its applicability to copper smelting plants is doubtful, owing to the vast amount of sulphurous acid gas emitted. There is, however, a mechanical method by the use of which the copper smelting plants, even with their enormous amounts of gas, may hope to reduce the sulphurous contents to a point where they will be practically harmless, and come within the limits prescribed by the courts. This mechanical method may be applied to existing plants, and its operation can be made practically automatic, that is to say, it can be regulated and operated by men of slight experience. The discharge of electricity of high potential through the gases is also being applied, the resulting precipitated dust and acid being claimed as an economy through recovery of by-products, though I do not hear that this method is claimed to reduce the sulphurous acid to sulphuric acid. It is to be hoped that with better understanding of the situation, with the application of known remedies, and the invention of new ones, this question will be solved without the necessity of giving the smelting industry a blow similar to that administered to the hydraulic mining industry many years ago. Your editorial is all right; get it re-printed.

JAS. W. NEILL.

Pasadena, California, December 29.

Lead Acetate in Cyanidation.

The Editor:

Sir—I should like to call the attention of other cyanide workers, especially of those using lead acetate in their work, to a case where, in a mill in charge of the writer several years ago, litharge was substituted for that salt, to good advantage. The material being treated was a concentrated tailing re-ground to pass 50 mesh, the greater part of the slime being removed before treatment by agitation in vats 20 by 20 ft. Thus the material agitated was largely fine sand, containing much pyrrhotite and a little arsenopyrite and chalcopyrite. The stirring action was very strong.

Soluble sulphides formed during treatment required the addition of at least 2½ lb. lead acetate per ton of solids in the charge. As this formed a heavy item of expense, William Magenau, the chemist of the mill, experimented with other lead salts and found that litharge, added to the charge in the proportion of 1½ lb. per ton, was equally effective. As litharge cost only half as much as acetate, it effected a reduction in cost for this item to 30% of the former figure. Besides, it was easier to use, simply requiring to be weighed and sifted into the agitating charge.

This substitution may not be generally applicable, nor in some cases even possible, but it has occurred to me that it might be used to advantage in tube-mill work, adding the litharge with the feed. This would be the logical place to add the litharge when grinding in tube-mills with cyanide solution, which, in my opinion, is likely to be the practice of the near future.

C. M. EYE.

Taracol, Korea, November 26.

PROTECTION OF INVESTORS.

The Mining and Metallurgical Society of America suggested the following questions for discussion among members:

1. What are the essential items of information which should be contained in mine reports for the full protection of investors?

2. How may mining companies be compelled to give such necessary items of information?

3. How often should such reports be published—monthly, quarterly, or annually?

The Pacific Coast section of the Society has held two meetings, at which these questions have been ventilated: the first was on November 21 and the second on December 19, 1908. The following transcript of the discussion will prove of general interest.

T. B. Comstock.—(Communication to the Secretary.)—First, in reports of active mining companies intended for perusal by average stockholders, itemizing is a ready means of observing results. Those who may require the details of operations should always have easy access to such information, and no harm can come ordinarily from publishing this widely. But a knowledge of certain facts is necessary to a clear understanding of the conditions of a business at any given stage. The form of statement demanded by law from National Banks is a good model for financial operations, although it is not, in every respect, what might be desired by individual stockholders.

Mining and metallurgical establishments are not so simply operated, and the status of their affairs demands more flexibility in accounting. The great desideratum in summary mine accounts is the utmost possible generalization without sacrifice of perspicuity. Ordinarily, it is sufficient, for instance, to lump all improvements, without specifying the relative costs of buildings, machinery, and other items. But it is important to make clear distinction between capital accounts and those affecting current loss and gain. Simple statements of actual resources and liabilities give all that is requisite, in the first instance, for determining the real financial standing of the company. However, it is rarely the case that, as with the banks, mining companies hold assets in such really tangible forms as currency and amply secured paper. There should be some recognized method of reporting mine resources in a manner to justify the estimates. The best and simplest procedure for this purpose would be the following of the financial statements with maps of workings and authenticated measurements and valuation of ore-reserves, accompanied with segregated costs of operation, based on a definite unit of quantity (as the ton of ore) and on output within the capacity of available plant.

Such details as cost of candles, explosives, labor, pumping, drilling, etc., are valuable, as statistics, and are necessary for capable and economical administration. But their appearance in administrative reports is generally indefensible. They tend often to confuse rather than to elucidate the actual condition of the business. Whenever, for exceptional reasons, this information may appear to be required, it is seldom necessary, in such reports, to give more than the general results, such as total average of costs per ton of all or a given part of the composites. Of greater significance is the very desirable comparison of results, period by period. Thus, if it appear that total costs per ton, on the average, have been measurably different in successive periods, the cause of such discrepancies should be plainly indicated, as higher labor rate, increased use of explosives, excessive inflow of water, greater proportion of waste, etc., or the reverse.

I am unable to suggest any adequate plan for ensuring the rendering of proper reports by mine managers, except those that depend mainly upon outside coercion. And these, under existing conditions, are of somewhat doubtful efficacy. Legal enactments will accomplish little unless they are of national application. To secure such scope is impracticable now, except by the almost hopeless achievement of equivalent statutes in all the States. The laws of England relating to the auditing of corporate accounts might be followed generally to advantage in this country; but it is not probable that this could be done by the National Government in a constitutional manner. California and New York, perhaps other States, have made a beginning by licensing accountants and thus giving permissive sanction, but without compulsion. Another method is feasible, though it lacks enforcing power beyond what prestige and, finally, custom might attach to it by way of influence. This is the adoption by our Society of a standard scheme, or skeleton administrative report, which would be announced as the basis upon which members of the Society would judge all offerings, and into which scheme, in some ways, all mining enterprises must fit or be considered at least lacking in definiteness.

This plan is not in any sense oppressive. It does not contemplate one whit more than is now exacted from any company which submits to examination of its status by an outside engineer. But it might enable the investor and his engineer to draw some general conclusions as to the investment value of the enterprise. For some years past, I have endeavored by correspondence and personal interviews to arouse the engineering fraternity to action along these lines. It would seem that some practical results ought to accrue from the present discussion. My own conclusion has been that too many have failed to realize how simple the scheme really need be to accomplish the desired ends.

As to the rate of periodicity of reports, varying conditions may possibly dictate diversity of performance. My rule, when clothed with authority, has always been to accumulate detailed records daily from every department, with daily summary reports from heads of departments to the general manager's office (or at least as often as mail service will permit); the board of directors, through the secretary, to receive weekly reports in some detail from the general manager, and monthly or quarterly progress reports to be issued to stockholders by the secretary. Sometimes these last reports are omitted as a regular issue. Monthly financial statements go from man-

ager to directors, with trial balance from general ledger. Usually stockholders receive statements, such as have been suggested, only at the annual meeting, and not in confusion of detail. But particular effort is given to classification of accounts and records in such manner that any director or stockholder can, at any moment, acquire the most accurate information concerning any point he may desire to investigate minutely.

After all, the main-spring of all accounting is system. If this be expertly arranged and rigidly enforced, there will be no difficulty in realizing all the benefits contemplated by this discussion. Without system in daily practice, no reports can be made to adequately epitomize the business of mining or anything else. By properly instituted and operated system the whole history is made self-recording and reports cannot go wrong, without discovery the moment any question is followed back along its proper course through the records. Simple statements similar to those emanating from Alaska-Treadwell are most satisfactory. Anyone familiar with accounts must recognize at a glance that these come not forth by guess or by crude computations from meagre data. They can only be made thus comprehensive and simple, though explicit, by careful attention to the amassing of details as they occur. By system, the mere stoppage of leaks that many mines disregard, yields the substantial dividends paid by the above mentioned and other well managed properties. Guard the wastes and the reports will not need a pattern presented by law or institute. They will become models by virtue of their inherent perspicuity.

F. J. H. Merrill.—(Communication to the Secretary.)—The proceedings of the New York section contain an important discussion of fundamental principles of mining investment, by Mr. H. S. Munroe, and this discussion is made the basis of a forceful resolution recommending that mining companies include in their annual reports certain accurate statements for the guidance of investors. The discussion and the resolution constitute a concise and conservative statement of information to which the investor is entitled in connection with established mines, but for the protection of the vast mass of the public that is daily invited to help forward with its savings the business of mining, a much broader influence must be exerted so as to cover the mining business in the primal stages of its various enterprises. For every investment made in established mines, hundreds are made in the development of prospects, and these investments are for the most part a result of the efforts of those active members of society known as 'promoters'.

The promoter is, essentially, a person who seeks profit by inducing others to invest. In the large majority of cases he knows little and cares less about the merits of the property on which he is selling stock, or which he wishes to capitalize. In a smaller number of instances he hopes, besides realizing a commission from the transfer or capitalization of a property to derive an income from future dividends or a substantial profit from appreciation of stock values. In a small minority of cases, he is an honest man with a merchantable proposition, striving to interest capital in a legitimate business.

Some means might be devised to separate the sheep from the goats and protect the investor. Practically there stands in the way that weakness of human nature which the late P. T. Barnum recognized and cultivated to his profit—the willingness to be deceived by marvelous tales. Everyone who has lived among mines knows the commercial status of a prospect. The most moderately well informed investor could acquire the general principles of the game of chance known as development. Yet, the human mind is such, that a good prospect, in a proved district, presented to the attention of investors in conservative language, telling only the truth, will sometimes linger and die a commercial death. On the other hand, the shabbiest pretense of mineralization, with scarcely enough ore to load a shot-gun, or just enough highly colored oxide or carbonate on the surface to furnish pigment for painting a dog-kennel, may, with the aid of neatly printed literature telling in glowing terms the story of hastening fortune, be capitalized for millions and its securities floated into the coffers of a complacent and expectant public. Often the cloak of religion is lent to this phase of frenzied finance, and a pulpit failure of a temperance lecturer becomes the mouthpiece of benign fortune offering itself to pious investors.

To my mind it is but a short step, ethically, from the highly cultivated art known as salesmanship, when applied to the distribution of manufactured articles, to the methods used in disposing of the stock of some mining companies. True, the manufactured article usually has some value, while the mining stock often has none, and by promises of impossible income persons are often led to invest their savings in mining stock to a larger extent than they could be in ordinary merchandise. But, the mental attitude of the salesman is often as cold-blooded in the one case as in the other and, so far as he is concerned, there may be no ethical distinction. He simply aims to make an income by inducing people to buy the wares he has to sell.

Various remedies are proposed for this abuse of confidence, one of them being the filing of reports on the character of the properties. We see, however, that it is expensive work, even for the Federal Government, to force corporations to tell all the truth about their business. Besides, unfortunately for the investor, the business of mining is of such a character that the promoter is often able to recite the mistakes of experts to stimulate hope among the ignorant. The history of Cananea is a favorite example. Turned down repeatedly by experts whose imagination could not foresee the possibilities of geological conditions with which they were unfamiliar, in the hands of men who fought for financial existence under the stimulus of hope rather than accurate knowledge, it became a great producer of copper. Under the supervision of paternal influences guarding the investor from speculation in unknown quantities, Cananea would never have been developed. On the other hand, at Tombstone we have seen the new Consoli-

dated Company organized under a maximum of expert advice and with substantial assurance of success, crippled by an unexpected and unprecedented flow of water, the pumping of which for several years has brought great expense upon the promoters of the enterprise and seriously delayed the development of the large orebodies which were expected at and below the 1000-ft. level.

In my judgment, the only safety lies in the education of the public to the point of realizing the elements comprised in the mining risk. Commercial statistics show that of those who engage in business only about 2% succeed. This applies to the business of the corner grocery, cigar stand, and other everyday items of commerce. Probably the mining record is no worse than this. The danger in mining, above other branches of business, is, in credulous and hopeful people being led to believe that unbusinesslike profits are certain and that ordinary business risks have been eliminated. The better way to protect the public is, therefore, to teach it that for one prospect that can be made a mine, many must fail; that a mine may be a success for one or two men, and too small to bear the expense of operation by a company; that a mine may succeed, and yet not pay larger returns than some safer form of investment; and that unusually large returns are, as a rule, only secured by taking large risks.

Another serious feature in mining, as in many other branches of business, is the fact that there are two separate and distinct elements, the quality of the property and the character of the management. A good mine may be unprofitable under careless management, and, on the other hand, a property of very low grade may, under economical and skillful management, be made to pay well. Many a group of investors has, to its sorrow, entrusted its money to a manager of the not uncommon type which takes for its guidance the motto: "A mine that needs careful management is no good."

There is probably no mining district in the world that does not bear traces of the operations of some company which began by rioting in extravagance and spent all its ready money in buildings, machinery, and general improvements before developing any ore. Dishonesty and incompetency in management can be guarded against in mining by methods similar to those employed in other branches of business, although it is inherent to mining that distance of the seat of operations from centres of civilization often exposes a superintendent to temptations and to opportunities for dishonesty that might not occur in a different business. On the other hand, in many cases the bulk of the stockholders' money is spent in city offices and salaries and never reaches the mine manager.

The conclusion to be drawn from all this is that the question of protecting the public from pitfalls in mining by legislation or other supervision is complex, and not simple. Commercial education will be by far a more potent factor.

F. W. Bradley.—While mine reports are generally elaborate as to working costs, and while information of that character is very fully given, they are shy on details as to the actual ore reserves. Detailed figures as to values and tonnage and the condition of the bottom of the mine are hardly ever found in such reports. I think that the full protection of investors calls for such details. I have in mind annual reports on a certain mining property in Mexico: I have looked through these reports for several years past for a statement of ore reserves in order to get some idea of the life of the mine. While ore reserves are touched upon as a mere incident, there is a vast amount of material to be found in these reports on the cost of the trail and the difficulties of getting stuff over the trail, the telephone line, houses for natives, and the difficulty of securing native labor, fuel, mules, etc. The point I am trying to make is that, for the protection of investors, a mining report should not only state facts as to costs and receipts, but that instead of reciting all the difficulties in connection therewith and elaborating on those difficulties, it would be better to give more detail as to ore reserves. There need be no apology for costs. There are always conditions that affect the costs, and a good manager cannot get away from conditions that are responsible for his costs, unless he has developed sufficient tonnage to justify him in going to the expense of changing such conditions as can be changed by creating better facilities. If there is any elaboration in a mining report it should be on the ore reserves and the developments as effects the future of the property. That is all that occurs to me in reference to the question: "What are the essential items of information which should be contained in mine reports for full protection of investors?"

George W. Starr.—In other words, your idea is that in giving ore reserves you should give the value of those ore reserves: the number of tons of a certain value, and give it in such a way as to indicate the value of the mine, not to give the tonnage alone.

F. W. Bradley.—Yes; my idea is that most mining reports evade what there is actually ahead in tonnage and value; that is the most important item to the stockholder. They elaborate on a great many things not of special interest to the stockholder, even though they are to the manager because they recite his troubles or hopes. The thing of specific interest to the stockholder, and which he should know for his full protection, is the life of the property and its future chances. That information is not to be found in most mining reports today, and in order to evade it, they have to elaborate on something else.

George W. Starr.—Don't you think it would be well in making reports to give the value of the tonnage: in stating ore reserves for certain levels to give the value per ton as well as the number of tons?

F. W. Bradley.—I think a manager should go on record at least once per year and make some kind of a guess as to the values and tonnage ahead of him. The nearer a manager can make his guess or estimate fit with the actual yield, the more valuable he is. Stockholders are entitled to truthful information, not only as to what a mine is doing, but as to what its future chances are, and they should not be deceived by reports that would needlessly elate or depress them.

MINING METHODS IN THE NORTH.—II.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

The frozen condition of the placers in Alaska and the Yukon seemed, at first, an insurmountable obstacle. In the end, it proved an aid to mining. To sink a shaft in the creek deposits of a warm climate means a persistent contest with water. Pumps are necessary, or a long and costly drainage adit. The loose ground requires careful timbering. Some of the best portions of the channel may be unworkable because of an excessive influx of water. All of this would have checkmated the diggers of the North in the early days of discovery. Pumps were 1500 to 2000 miles away, heavy timbers were scarcely to be obtained in most localities, a fight with water would have discouraged men unused to mining, as were most of those that rushed to Dawson, Fairbanks, and Nome.

The frost, indeed, was the miner's friend. It enabled him to sink a shaft even in the bed of the creek; it permitted him to dispense with timbering; it allowed him to burrow with safety and to follow the layer of golden gravel with impunity under the ice-bound surface. Moreover, it obviated work on a large scale. One man could, and sometimes did, work alone, descending the shaft, filling the bucket, ascending to the surface, hoisting the load, and so forth. No machinery was needed save the simplest tools; no organization was required, beyond a willing partner; no capital, save muscle.

Even today the prospector avoids the thawed areas. Such exist along certain running streams, and in flats where the moss has been washed away. Evidence of a thaw is afforded by the vegetation, for willows will not grow where the gravel is frozen. In some cases a river valley may be partly thawed, partly frozen. In many instances the work of 'drifting' has to be confined to the sides of a channel, the centre being dangerous on account of caving, due to thawing. Thus Bear creek, a tributary of the Klondike, proved unsuited to drift-mining on account of water, and many rich spots in that valley remain virgin for this reason. Most of the pioneers were so inexperienced that they started work in the centre of the claim, instead of at the lower boundary and working upward, so as to utilize the gradient. Thus No. 38 Below Discovery on Bonanza was worked in the winter of 1897, and at intervals since, being finally sold for $3500. It was supposed to be exhausted. Yet last July the operations of 6 men per shift, or 12 altogether, merely by shoveling into sluice-boxes from an open-cut, cleared $1200 in two days.

The method of shoveling into sluice-boxes is suited to shallow rich ground. This form of mining supplements ground-sluicing. The prospector first tests the gravel by washing a sample in a pan. A pan holds about 20 lb. of ordinary gravel. Next he may employ a 'long-tom', essentially an inclined surface over which the gravel is washed. From 6 to 10 ft. of launder or sluice is set at an angle; at the head of it a hopper or box serves to hold from 50 to 150 lb. of material, which is then flushed, a little at a time, down the slope, by the action of water thrown out of a scoop or small bucket fixed to a handle. To arrest the gold, cross-bars or riffles are nailed to the bottom of the launder. In addition, mercury may be employed, or even amalgamated copper plate. In such a case the plate is covered with wire screen or perforated sheet-iron, the effect of which is to size the gravel, causing the larger pebbles to slide down the slope, while the fine stuff sinks through the apertures and comes in contact with the mercury and amalgam. The 'long-tom' was familiar to the early Californian miners, and in its simplest form dates back to the very beginning of the world-wide search for gold. In order to facilitate the saving of gold, a shaking motion was imparted, merely by placing the inclined sluice-box or launder upon rockers. This constituted the 'rocker', which is shorter and more compact than the 'long-tom', the quicker separation of the gold rendering unnecessary a long surface. Much gold has been won by means of these devices. They are still in use.

On the sea-beach at Nome the traveler can observe the simpler forms of gold-saving apparatus. In August, 1908, more than 100 men were employed in washing the 'ruby' sand concentrated by the action of the surf along the foreshore. The sand has a brick-red color by reason of the garnet it contains; this garnet is derived from the prevailing country rock of the region, namely, schist. Through the erosion of the schist the gold also was liberated from quartz veins and concentrated by the waves that in tidal sequence play upon the shelving strand. The arrangement employed to extract this gold is a form of long-tom, consisting of an inclined box or sluice with a false bottom of galvanized iron, or tin-plate from a coal-oil can. This is punctured with holes so as to act as a screen separating the fine stuff from the coarse; the latter runs down the slope into the sea, at the edge of which the apparatus is erected. The fine sand, including the particles of gold, drops through the false-bottom on amalgamating plates. These are of copper, usually silver-plated. At the end of the copper-plate there is, ordinarily, a bit of carpet, matting, or wire netting to serve as a check on any gold or amalgam escaping from above. At the upper end of the box or launder, the sides are raised, or a regular hopper is constructed; into this the sand is discharged from a bucket, emptied from a wheelbarrow, or shoveled direct from the ground that is being exploited. While one operator attends to this part of the work, his partner is furnishing the water to wash the sand down the incline, standing with gum-boots in the tide and swinging a ladle consisting of a bucket fixed to a long wooden handle. Sometimes, for convenience, a temporary dam is made with bags of sand, forming a pool which is renewed by the waves that break over it at intervals. Some of the contrivances that I saw were pathetically crude; in one instance, a small strip of old carpet and a few globules of mercury constituted the gold-saving device. In 1899, the beach-workers got as much as $5 to $10 per pan; and even with the roughest contrivances, of the kind just described, some in-

dividuals in one summer season of only four months took $30,000 to $40,000 from the diggings on the shore. Today a man can still make $3 per day on the Nome beach. Two partners told me that they made $60 in 3 days. Another operator and his partner got 3½ ounces of amalgam, yielding a little over an ounce of gold, on the day previous. Storms reconcentrate the sand repeatedly; the appliances required are cheap and easily constructed. It is a poor man's mine.



A Rocker in Service.

A more elaborate arrangement to be seen on the Nome beach is an extension of the long-tom, being an inclined series of sluice-boxes. From 6 to 10 of these are stretched end-to-end and lined with cocoanut matting, on which a screen of woven wire is spread. This is from 4 to 2 mesh and even coarser. Mercury is sprinkled on the matting by means of a bottle stoppered with a cloth. The apparatus is set so that the refuse falls into the sea and is removed by the waves. A gasoline engine pumps the water needed for washing the gold-bearing sand. The intake of the pipe is in the sea, and is provided with a screen so as to keep out the drift-wood. Sometimes the pipe rests on a runner, made of two wheels and a connecting axle, so that it can be withdrawn to safety in case of stormy weather, for tremendous storms occasionally smite this unprotected coast and smash all the machinery built by the men who are digging fortunes from the fringe of Bering Sea.

Sampling with a pan was followed by extraction on a small scale by means of rocker or long-tom. Such washing was intermittent and did not require much water. If the creek deposit warranted an enlargement of the operation, the next thing was to shovel into a longer sluice-box or series of sluice-boxes, and wash the gravel by means of a more nearly continuous supply of water conducted through a canvas hose. This hose is flexible and easily transported; it is usually 14 in. diam. and made of 12 to 14 oz. duck, sewed with 3 seams. Such a hose will last for one season, of four months, the short life being due not to the effect of the water but of the dirt, which causes the thread to rot. In the accompanying photograph this method of mining is clearly illustrated, although, as usual, the value of the illustration is lessened by the posing of the workmen. The hose can be seen delivering water (say, one sluice-head or 50 miner's inches, equal to 75 cu. ft. per minute) into the sluice-boxes. These are four in number, each one being 12 ft. long and 12 to 14 in. wide. They are set on a grade of 8 in. per 12 ft. As the water courses down the inclined surface, the men shovel the gravel into the current, which separates the light and valueless pebbles from the heavy and valuable gold. The small particles of gold are arrested behind the riffles placed in the last two sluice-boxes. These riffles may be either simply cross-bars nailed to the bottom and retaining a sprinkling of mercury, or they may be solid blocks of wood placed along the bottom with small spaces between, so as to make a pavement full of little traps for the gold. As the ground is worked out, the sluice-boxes are shifted so that the shoveling is facilitated. If the deposit is wide, it becomes necessary to erect laterals or radiating sluice-boxes, feeding the



On the Beach at Nome.

main run-way. These are laid on a steeper grade and are narrower than the trunk line of sluice-boxes.

As an example of this simple form of alluvial mining, I may instance the work done for Frank G. Manley on Thanksgiving creek, in the Hot Springs district. First, the moss is removed by means of mattocks; most of it is piled up and burned; the remainder is washed away in the succeeding operations. The top gravel, which is nearly barren and 6 ft. deep, is then ground-sluiced, that is, it is washed with a nozzle under small pressure into sluice-boxes laid on the bedrock, which is one foot deeper than the 6 ft. of overburden. The bottom gravel, one foot thick, and the bedrock underneath, to the depth of another foot, are worked with pick and shovel. When loosened, this mixture of soft schist and gravel is shoveled into the lateral sluice-boxes. These are 12 in. wide tapering 10 in., they are 10 in. deep and lined with pole riffles. Each riffle consists of three or four spruce poles 6 ft. long, 1 to 2 in. apart, held together at each end by being nailed to a transverse bar. These 'shoveling-in' sluices are not more than 60 ft. long, and discharge into the main line of sluices, 18 in. wide, and lined for a length of 500 ft. with wooden blocks 8½ in. square and 1 in. apart. The gradient is 2½%, diminishing at the lower end to 1½ ft. per 100. As the gravel is shoveled into the sluice-boxes, the men throw the large pebbles or boulders to one side.

This deposit is from 8 to 35 ft. deep, being shallowest up-stream. It has been worked for a width of 100 to 140 ft. and is profitable for a length of 7000 ft. The bedrock is flat, only slightly more than 2½%; the result is a difficulty in disposing of the tailing. This is overcome by the use of machinery, namely, a scraper of the bottomless type, made by the Washington Iron Works, Seattle. The movements, to and fro, of the scraper are directed by two reels, one of which hauls it forward while the other pulls it back by means of steel ropes. By the use of two ropes, attached to the rear end of the scraper, it is possible to shift it easily and cover more space. The nominal capacity of this mechanical shovel is 1¾ cu. yd., but it actually moves one yard at a time. One engineer attends to the whole operation, the scraper digging into the tailing as it accumulates at the foot of the sluice-boxes. One cord of wood suffices to move 200 yards. At the time of my visit (August 12, 1908) 28 men (14 on each shift) were shoveling into the sluices, and the scraper handled the resulting tailing in 5 hours. A clean-up made on that date from the two feet of material covering 4500 sq. ft. of bedrock, yielded 296 oz. gold, worth $15.50 per ounce. This included gold that had been in the 6 ft. of overburden. The effect of ground-sluicing is to concentrate, the gold sinking on the deeper stratum as the associated detrital material is washed away. Therefore the yield was $4588 from 36,000 cu. ft. of alluvium, equivalent to $3.41 per cubic yard.

A good example of mining on a small scale by an individual is afforded by Pappen's Bench, a patch of rich alluvium on the north side of Pioneer creek, in the district just mentioned. The gold-bearing material is 3 ft. thick, feathering to nothing at the lower limit; it is 200 ft. wide and perhaps twice as long; it contains gold at the rate of 35 to 50 cents per square foot. Henry Pappen, the discoverer, removed the top dirt and washed the foot or so of stuff lying on the bedrock. This is a slate. No large boulders exist in the deposit. Sedimentation is apparent. The overburden is a light dirt, such as would be washed down a side hill. The grade is 12 ft. in 100 ft. Pappen made $21 per day with a rocker, erected 200 to 300 ft. below his 'mine'. He trundled 25 wheelbarrows per day. Being short of water and far above the creek, he built a little reservoir on the hillside, making a brush fence to serve as a dam, behind which he caught the drifting snow. Not getting sufficient, he actually hauled snow on a sled and banked it behind his snow-fence or reservoir. The thaw yielded the water he required. But not for long. A wind-storm arose, having a contrary direction, so violent as to blow away his reservoir!

This example of perseverance is worthy of a 'sourdough', as the old timers are called. It reminds me of a scheme, credited to Henry Bratnober, of storing the equivalent of water by erecting snow-fences, such as are built to protect railroads. This idea was ventilated last summer, but it was not deemed practicable. On the other hand, it has been suggested that artificial glaciers would store water, the idea being to lead small streams to form large masses of ice during winter and early spring, so as to keep the water near the head of the watercourse, where it can be diverted in summer into the ditches of the miner.

Thanksgiving creek illustrates many of the fundamental problems of placer mining in the North. Ordinary drifting operations, in the old way, by thawing with wood fires, as already described, were rendered impossible by slabs of ice in the clay that constituted a large part of the overburden. This ice would melt so fast as to extinguish the fire before it could heat the gravel adjoining. Moreover, the deposit was too shallow for 'drifting' except at its lower end. It was a strange locality for a placer mine. Thanksgiving creek is a creek only by courtesy; it is a gently shelving plain, almost a flat, a good deal like a tamarack swamp; in fact, the lower end of the 'creek' is a morass devoid of a gravel bed. In 1903 several shafts were sunk (on No. 2 Above) to a maximum depth of 30 ft. These bottomed in a dense dark-blue mud or 'gumbo'. No gold-bearing gravel was found. A drill-hole put down in July, 1908 (by a No. 3 Keystone traction drilling machine) went through the 'gumbo' and disclosed 8 ft. of clay and gravel lying on a hard slate bedrock. This hole yielded gold at the rate of $4 per sq. ft. of bedrock, the total depth being 38 ft. Most of the prospectors in this locality were misled by the 'gumbo'. Another trouble was due to the yellowish clay in the overburden, this made it difficult to arrest the gold. Some of the old tailing piles have been re-worked; in one instance two men made $45 apiece per shift by shoveling into sluice-boxes. Later they themselves re-worked their own tailing and made $15 per day. This suffices to emphasize the poor gold-saving. Some men take great pains to mine their ground and then

show strange carelessness in extracting the gold.

As an example of operations on a larger scale, I may mention What Cheer bar, another bench-deposit on the hillside above Pioneer creek. This is part of the large property controlled by Frank G. Manley.



Shoveling into Sluice-Boxes. No. 1 Above, Anvil Creek.



Thanksgiving Creek. Tailing Dump in Foreground.

In preparing the ground for mining, the first step is to cut down the thin forest of small spruce, then the stumps (2½ ft. high) are pulled out by horses. It costs from $250 to $300 per acre to clear the ground. Next a wing or solid-tooth harrow is dragged over the surface so as to tear the moss and pull it out by the roots. This moss is then gathered into heaps and burned. Finally, diagonal furrows are ploughed 10 to 12 ft. apart, water is turned into the furrow so as to deepen it and hasten the thawing of the ground. The whole operation is directed toward exposing the frozen gravel to the action of the sun. When the natural thawing has reached bedrock—only 7 ft. below the moss, which is 6 to 12 in. thick—the deposit is ready to be washed.

MODIFIED PROVISIONS OF MEXICAN MINING LAW.

*The new mining law, modified according to the action of the President and the Cabinet, has been submitted to Congress, and will become effective as submitted. It consists of 150 articles, embodying the present laws and the decrees and regulations that have been in force, with some important changes, mostly with the view of removing conflicts in the legal provisions which have been developed during several years. The advantage of a simplified code for mining is obvious and important, as those who have been concerned in the interpretation of the existing statutes will admit. The regulation as to pertenencias remains as now. In Article 3 it is provided that matters relating to mining property become subject to the civil code of the Federal District, except as specifically determined otherwise in the law itself. This is of legal interest. The provisions relating to the restriction of mining rights to Mexican companies is absent from the draft submitted, and, what is also important, the restrictions which required the foreigner to secure executive permission to locate claims in the border States is made to apply only to an 80 kilometre zone on the boundaries. However, the conditions of the suppressed Article 144, disqualifying foreign corporations, is made to apply absolutely to this zone. This is likely to affect operations in some of the important districts of Sonora and Chihuahua. Of course, it does not apply to existing conditions of ownership, and there is always the fairly satisfactory expedient of a Mexican holding company with its stock controlled by a foreign corporation, as is now done in several cases.

The articles bearing on these points are as follows:

Article 134. No title-deed to mining property can be issued to foreigners denouncing claims in a zone 80 kilometres wide along the boundary line with foreign States, unless they previously obtain special permission from the executive of the Union. The same formality is necessary when the denouncement is made conjointly by foreigners and citizens. If the permission be refused, the ground denounced will be declared free.

Article 135. The permission to which the foregoing article refers will be necessary to enable foreigners to acquire by any other method mining properties, or liens thereon, within said 80-kilometre zone.

Article 137. Foreign companies are incapable of denouncing or acquiring by any means mining properties or liens thereon, within the zone mentioned in Article 134.

Article 138. All acquisitions in contravention of Articles 134 to 137 of this law are null and void. Suits for their nullification can be instituted either by a party in interest or by the Federal prosecuting attorney, acting under instructions from the Department of Fomento.

Article 139. When by inheritance or judicial award, in payment of a debt, a foreigner acquires property coming within the scope of Articles 134 and 135, he will be allowed a year to alienate such property, unless before the expiration of that time he shall have secured the permission referred to in the same articles.

Article 140. When a foreign company is the beneficiary of the inheritance or judicial adjudication, it must perforce alienate the property within the period of one year.

The law will come into effect July 1, 1909, except that the provisions as to prospecting permits, which are not recognized in the new law, become effective after the promulgation of the law. It is reported that the authorities have not found the results from these permits satisfactory, and that this is the reason for the action taken. The submission of the law and the generally satisfactory outcome of the matter has already had the good effect of restoring full confidence in the Mexican mining industry on the part of foreign investors, a condition which is made more and more evident each day.

In the withdrawal of Article 144 from the new mining law the regulations for foreign corporations are in force as heretofore. The formalities to which foreign companies desiring to do business in Mexico are subject are as follows: Foreign corporations which desire to become established or to create branches in the Republic shall present and cause to be recorded in the Commercial Registry, in addition to a protocolized copy of their statutes, contracts, and other documents relating to their incorporation, an inventory, or their latest balance-sheet, if they have any, as well as a certificate proving that they have been organized and authorized to do business under the laws of their respective countries, said certificate being issued by the Minister of the Republic accredited to each country, or, if there be no Minister, by the Mexican Consul.

The chief expense connected with this formality is the stamp tax on capital, which is one per mil for the first $500,000; 0.50 per mil on the second $500,000; and 0.10 per mil on the capital in excess of $1,000,000.

The documents usually required are a certified copy of the charter, a certified copy of the by-laws, and the certificate of legal incorporation issued by the Mexican Minister or consul. These documents are placed in the hands of a notary-public, who presents them to one of the civil judges, with an application for authorization to 'protocolize' them. The judge, if he finds the papers in order, and the translations, on the faith of an expert's declaration, seem accurate, hands down an order for the protocolization of the documents, which for that purpose are returned to the notary. The notary makes a summary of the documents and enters it in his 'protocol,' adding the original documents themselves to the appendix. He is bound to pay the stamp tax imposed by law on the operation, and he then makes a transcript of the documents, or their translation, certifying to its exact conformity with the originals. This transcript is presented at the Commercial Registry for inscription and annotation. The 'testimonio' is delivered to the representative of the company in Mexico, to be held by him as evidence of the legal existence of the company in the Republic.

*Abstracted from the *Mexican Mining Journal.*

THE COPPER OUTLOOK.

Written for the MINING AND SCIENTIFIC PRESS
By M. E. APPELBAUM.

The history of 'copper metal' during the year 1908 was featureless as compared with previous years, and especially with 1907. The market had its periods of weakness and strength, according to the drift of business, but there was notable steadiness of price in the face of unsatisfactory statistics and reported accumulations of metals on the other side, and when we consider the fact that not until near the close of this year did American consumers operate their works even to the extent of 70 to 80% normal, we must come to the conclusion that statistics do not always enable us correctly to judge the market.

In view of the extremely unfavorable conditions that ruled during the greater part of the year, taking into consideration that the production of 1908 has been a record one, and the consumption the poorest in years, and that in spite of it the metal had not again touched the low level established in October, 1907, the conclusion is inevitable that the reported stocks on hand in this country or in Europe are grossly exaggerated. If, however, large stocks are held, it must be by producers who see such enormous consumption of copper in years to come as to be able to dispose of it with handsome profits without disturbing the market as soon as an advance takes place.

Some authorities claim that we start the year with a stock of one to two hundred million pounds. If that be true, it must certainly be that the copper has been carefully concealed beyond trace, and also that the stock on hand must be electrolytic copper only.

One of the best illustrations as to how little copper is available for immediate delivery is the fact that in November, 1907, when navigation closed, about 15 to 20 million pounds of Lake copper was shipped to Buffalo, which meant a saving to the producers of about ¼ cent per pound, the difference between lake-and-rail and all-rail rates. This copper was on the market in December and for a few months after, until it was finally absorbed; by that time, of course, new stocks of Lake copper had accumulated. I can state definitely that this year all the Lake producers did not ship to Buffalo more than about 2,000,000 lb. copper, and some of it had already been sold for delivery at Eastern points during the month of December, so that the actual stock was almost nil.

Now, as to electrolytic copper: The independent selling companies have disposed of their output up to January 1, and therefore the accumulated stock, if any, must be in the hands of the largest selling company. If such were the case, it is difficult to understand why that company should withdraw from the market, as was the case in December, and allow the independents to take whatever orders they might choose. My opinion is, however, that none of the selling companies have any copper to speak of, outside of the material already in process of refining.

There remains the European situation: It has been an acknowledged fact that Europe has always been willing to carry a few hundred million pounds of copper at about the level of 13 to 14 cents per pound. When copper began to advance several years ago, everyone in the trade suggested that a big advance was impossible because the Europeans were over-stocked. As a matter of fact, however, it proved that the copper was carried in Europe in the hands of strong consumers, who simply accumulate at low prices and consume it by the time the market advances; as the demand grows sharper, they again turn buyers, and the same course of events is likely to take place now.

The reports received from Germany, France, and England are of an encouraging nature and such as to make one believe that the rate of exports established during the greater part of 1908 will be closely followed, if not fully maintained, and when one considers the enormous plans for the electrification of the railroads in the United States and Canada, and the fact that it is reasonable to expect a good business year, it is warrantable to suppose that the stocks of copper, if any, will be used up, and that before many months of good business, sharp advances will take place on account of the inability of the producers to supply the demand.

That the visible supply of copper at the present moment is large can best be answered by the fact that when copper was at 26c., and when everyone was predicting 30c. copper, the visible supplies were the smallest on record. Now, when copper is selling at a low level, and the visible supplies are large, everyone is predicting lower prices. A great deal has been said about the production and consumption in the United States; it is easier to estimate the former than the latter. The total production of copper is about one billion pounds, and the consumption in this country is estimated at between four and six hundred million pounds, and if the large exports are added, I again fail to see where the large accumulation could have taken place in this country.

The metal is in an exceedingly healthy state, especially in this country, where the speculatively inclined dealers, who make large commitments of copper, having during the last two months been disappointed with the rather quiet state of the market, sold out their large purchases made before the election; in fact, some of them have been known to turn on the short side, both in London warrants as well as domestic copper.

It is difficult to understand why, if there are large accumulations of copper in this country and in Europe, one can dispose of reasonably large quantities of copper to American consumers at a concession of only 2½ to 5 points, which has been the case during November and December when some of the dealers tried to realize on their pre-election purchases. Another good feature is that the American consumers have been buying for near-by deliveries, indicating that they are supplying their wants as needed and are not buying copper simply on account of an expected advance. Almost nine-tenths of the American consumers have bought very little copper beyond the first of January, and if business will continue to improve we should, by the middle of 1909, be back to a prosperous condition.

SILVER COATING OF AMALGAMATING PLATES.

By W. A. Caldecott.

*While electro-plated copper plates have never come into general use in the Transvaal, and while some of the virtues attributed to them may have little better foundation than the fond fancies of the old-time millman, there is yet do doubt that the percentage recovery by amalgamation in the early stages of starting a new mill with plain copper plates is by no means satisfactory. When more stamps or tube-mills and shaking tables are added to a plant already in operation, a little amalgam can usually be spared from existing plates to 'set' the new plates, but even so, greenish stains and patches for some time offend the amalgamator's eye and defer the day when he can view with satisfaction a uniform silvery surface persisting from one dressing till the next.

The use of silver amalgam for setting purposes has frequently been recommended, and I have experimented upon it in various ways, dating from early but unsatisfactory attempts that involved much labor in filing silver coins into powder. The simple method finally adopted was based upon obtaining a pure silver amalgam of buttery consistence containing the silver in the finest possible state of division. If such an amalgam is applied to plain copper plates after the usual scouring some two or three weeks before the plate is put into service, and the plate frequently dressed with the same amalgam during this period, the silver amalgam is given the opportunity to become thoroughly incorporated with the surface of the plate, with consequent benefit to amalgamation when the stamps or tube-mills are started.

Silver amalgam is now commercially obtainable, but if preferred it can be prepared in the manner described by Louis,† as follows:

"A sufficient quantity of silver coin (about ¼ oz. per square foot of surface of the tables) is dissolved in dilute nitric acid in a porcelain basin with the aid of a gentle heat. The solution is evaporated to dryness very gently, preferably over a water bath, and then heated till the saline mass commences to fuse, and till all its bluish tinge is turned to grayish black, this change indicating that all the soluble cupric nitrate is decomposed, insoluble cupric oxide being left behind. The salt is then dissolved in a small quantity of water and filtered into a jar or beaker. Pure mercury to the weight of about three times that of the silver used, is poured in, a few drops of nitric acid added, and a few pieces of bright iron floated on the surface of the mercury. The silver will at once commence to precipitate and be absorbed by the mercury forming silver amalgam, the process taking a few days to complete thoroughly. The silver amalgam so produced should be of a pasty consistence."

In carrying out the foregoing method, it will be found that small silver coins dissolve more readily than the larger ones, and that small wire nails provide the iron required in a convenient form. In the process an iron-mercury couple is formed; this serves to deposit the silver present in solution upon the surface of the mercury, which immediately absorbs it while a corresponding amount of iron is dissolved.

If pure silver can be obtained, the evaporation of its solution in nitric acid, with subsequent heating to remove the copper, may be omitted and the process thus simplified, but if silver coin containing copper is used as a ready though somewhat expensive source of silver, and the copper not removed, the resulting silver-copper amalgam will show a greenish surface film soon after application to the plates, owing to oxidation of the copper present. The molecular state of fineness of the silver in the amalgam permits a much more perfect coalescence between the surface of the copper plate and the amalgam than when coarse particles of metallic silver are present in the latter. To ensure, however, a silver amalgam coating that will not tarnish on exposure to the air, time for absorption must be allowed; for this reason the preparation of the plates some time before use is recommended. After milling has started, the coating of silver amalgam is gradually removed from the plates as gold amalgam is scraped off, but by the time the former is all gone its purpose will have been served and its place taken by an equally efficient and permanent coating of gold amalgam.

The cost of coating copper plates with silver in the manner described is relatively small as compared to the value of the amalgamable gold that otherwise passes away with the tailing in the early stages of crushing, and the allowance of half an ounce of silver per square foot of plate area is certainly liberal, as in my own experience a considerably less proportion than this has sufficed.

*From advance proofs of the Chemical Mining & Metallurgical Society of South Africa. By courtesy of the author.

†'Handbook of Gold Milling,' page 313.

Minerals that are deposited in veins of moderate depth associated with igneous rocks, and which are probably altogether primary in such deposits, according to W. H. Emmons, are: arsenopyrite, bismuthinite, calaverite, cobaltite, fluorite, kalgoorlite, molybdenite, muscovite, orthoclase, petzite, rhodonite, stibnite, sylvanite, tellurides, tetradymite, and turquoise. Minerals that are secondary in deposits associated with igneous rocks, but not known to be primary, are alum, amalgam, anglesite, antimony, apophyllite, arsenic, atacamite, azurite, aurichalcite, bismuth, bromyrite, calamite, caledonite, calomel, cerussite, chalcanthite, chrysocolla, covellite, cuprite, goslarite, gypsum, hydrozincite, lead, leadhillite, limonite, malachite, manganite, melaconite, mercury, molybdite, psilomelane, pyrolusite, pyromorphite, smithsonite, stromeyerite, tin, and turgite. Few sulphides are limited to secondary deposits; covellite is probably limited to this group, and most chalcocite is secondary.

In the German Empire there are 60 cities having a population of 50,000 or more. Of these, 44 own and operate gasworks, 38 operate electric light plants, 43 have municipal water works, and 10 have their own street railways.

THE NEVADA METEORITE.

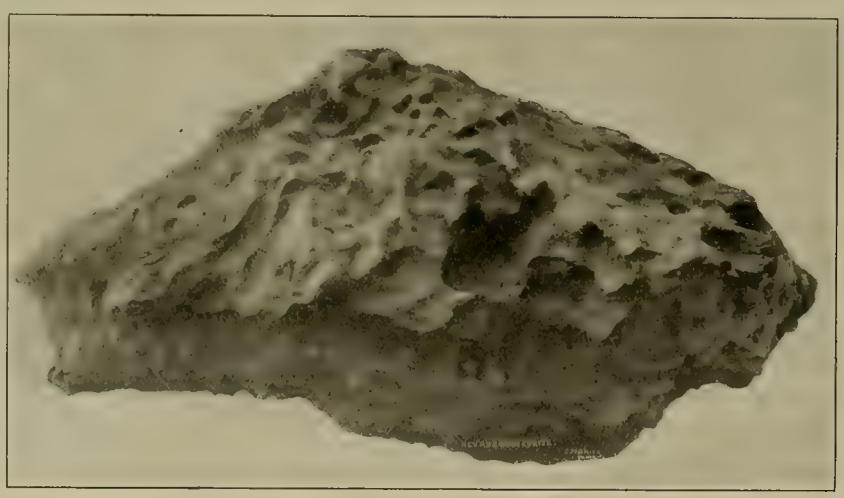
Written for the MINING AND SCIENTIFIC PRESS
By WALTER P. JENNEY.

In the latter part of August of this year (1908) a prospector looking for borax in the Quinn Canyon range, in Nye county, Nevada, discovered and located a mass of metallic iron, which he found lying half-buried in the soil among the foot-hills of the range. Cutting off a few small pieces of the metal with a cold-chisel, he returned to Tonopah, where he sold out all his interest in the find and soon after left the country. The region where the meteorite fell is almost uninhabited save for a few sheep-herders and occasional wandering prospectors. The Quinn Canyon range, marked on some maps as the Grant mountains, bounds Railroad valley on the east and, by wagon-road, is nearly due east 110 miles from Tonopah.

The purchaser placed the matter in my hands with instructions to find the meteorite, bring it to Tonopah, and open negotiations with various museums in this country for its sale.

Only a general and imperfect description of the locality had been obtained from the original discoverer and, in consequence, the first attempt to find the meteorite failed; it was not until a second search was made that, with the help of a guide, it was found. These two trips by automobile made by me to find the meteorite covered 430 miles. Later a freight-wagon with six horses and three men, provided with a derrick and chain-pulleys went to Quinn Canyon and hauled the meteorite to Tonopah, the nearest shipping point on a railroad; the round trip consuming eight days. Great care was taken that the polished surface of the meteorite should not suffer abrasion; as soon as loosened from its bed, it was wrapped in sacking and reached the Tonopah Bank, where it is now stored, unimpaired.

The point where the meteorite fell is 90 miles due east of Tonopah, 18 miles north of the Mount Diablo base line, and 100 miles west of the Utah boundary. It was lying partly embedded in the soil of a low hill of volcanic rock (andesite), on the westerly slope of the range. The foot-hills in the vicinity are treeless and support a sparce growth of sage-brush and grass. The gentle slope on which the meteorite lay faced northerly and the contour of the surrounding hills was such that, in falling, its course through the air, if at a low angle, may have been easterly, southerly, or southwesterly. It bears some resemblance in shape to a great turtle, and when found was resting on its flat side, with the domed or pyramidal upper surface projecting above ground. The longest dimensions, as it lay, were easterly and westerly, and the depth to which it was buried in the mantle of soil covering the hill did not exceed 10 to 11 in. The countour of the surface of the ground had resulted from extremely slow erosion; there was no evidence that the meteorite had ever been deeper buried, and subsequently exposed by the wearing away of the hillside. The deeply chan-



The Nevada Meteorite.

neled and pitted upper surface of the meteorite was covered with a thin smooth skin of magnetic oxide, which had protected it from corrosion; even the portion buried was little rusted. The outline, while extremely irregular, is rudely oval, measuring on each diagonal of the ellipse, 44 in.; the breadth is 34 in., and the circumference 132 in. It is 20 in. high and is estimated to weigh 4000 lb. A few small prominences were cut off by the prospector who found it, in order to determine the composition; the amount removed was not more than one or two ounces, so that the meteorite is practically as it fell. Analysis shows that this meteorite contains from 90 to 95% iron alloyed with 5 to 10% nickel. On etching a polished surface, the Widmannstättian figures appear as closely spaced brilliant lines an a dark ground; in places the outer surface of the meteorite displays an octohedral crystalline structure in grouped equilateral triangles. However, the characteristic Widmannstättian pattern can only be obtained when a large surface of the meteorite is etched.

All the evidence gained from an inspection of the

meteorite before it was removed from its bed, seems to support the view that it is a comparatively recent fall, probably within the last 20 years. The wonderful preservation of the surface shows that it has not been long exposed to the weather. The deeply channeled surface, produced by the liquation and combustion of the complex metallic alloy, caused by the intense heat generated in its passage through the Earth's atmosphere, is evidence that the meteor traveled far, before coming to rest where found; that is, its path must have been nearly tangent to the surface of the Earth. This is confirmed by the shallow depth it penetrated the soil; further, it is possible that it richotted on the flat side before the momentum with which it was traveling was finally arrested.

This aerolite is supposed to have fallen in 1894. Residents of Candelaria, at that time, recall the passage of an immense meteor that traveled in an easterly direction and was seen to fall far to the east, beyond where Tonopah now stands. Articles appeared in the San Francisco *Examiner* and in other California papers, describing this meteor as entering the Earth's atmosphere over the Pacific Ocean, crossing the Coast range, the Sacramento valley, the Sierra Nevada mountains, passing nearly over Bodie (California) and Belleville and Candelaria (Nevada), to be lost in the desert to the east. Its fall was recorded by the U. S. Weather Bureau at Reno, Nevada. Several residents of Tonopah saw the meteor when it fell. Among them is Fred Corkhill, superintendent of the West End Mining Co. Mr. Corkhill, who at that time was living in Candelaria, states that on February 1, 1894, about 10 o'clock in the evening the residents of Candelaria observed the meteor, which passed directly over that place and was seen to disappear in the east. It gave an intense blinding blue-white light, so dazzling that you could not see the meteor itself. The illumination was so intense that the interior of rooms in the buildings that had shutters closed was lighted up as brilliantly as day. The rush of air after the passage of the meteor lasted a minute or more. After it had passed there was a loud explosion accompanied by a powerful jar. Mr. Corkhill wrote an article on this meteor and it was published in the MINING AND SCIENTIFIC PRESS in the spring of 1894. The place where the meteorite was found is 130 miles due east from Candelaria.

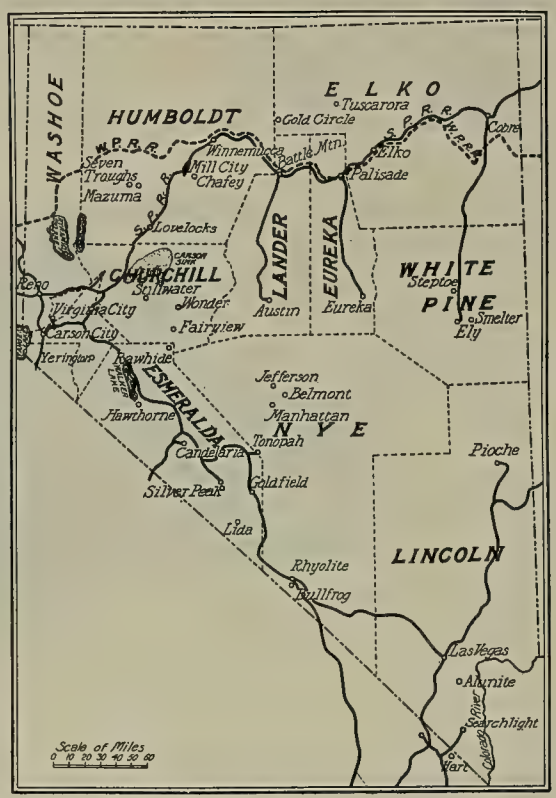
[Here follows the account sent my Mr. Corkhill to the MINING AND SCIENTIFIC PRESS of February 10, 1894.—EDITOR.]

To the Editor: I send a description of the meteor that fell at this place on the night of February 1st. The thermometer registered 15 degrees above zero. At 10 o'clock 7 minutes a brilliant meteor appeared, coming from the southwest. It made a tremendous illumination, suddenly, as if a great flash light was thrown in well-lighted rooms, wherever a corner of window curtain or shade was not tightly drawn. So intense was it in brilliancy that those who were out of doors were dazed, and but few could tell whence it came or whither it went. It was of a dazzling electric blue, like many arc lights had suddenly shot into existence. The illumination lasted about four seconds, disappearing in the northeast. The illumination brought all who were awake to their doors, awe stricken, thinking some slumbering crater had burst into flame.

Thirty seconds later a terrific explosion occurred, like tons of dynamite suddenly exploded, shaking the hills and echoing through the rocky caverns.

It was like a huge bombshell had been hurled in our midst. There followed a boiling and sizzling roar, like an immense mass of red-hot iron cooling in water. The sound grew fainter and gradually died away. This lasted about fifteen seconds.

Those who were sleeping and did not see the illumination were aroused and rushed out of doors,



Showing Position of Tonopah and Candelaria.

supposing it to be an earthquake or that the crack of doom had come.

When the snow melts and the focus of the explosion is definitely located, a search will be made for the meteorite.

None who saw or heard this meteor will forget it, and they will relate it in future years as a great event; nor will any one here desire to be nearer to those celestial bombs than he was this night. Some ducked their heads to let it go by and considered it a very close shot for a star.

FRED CORKHILL.

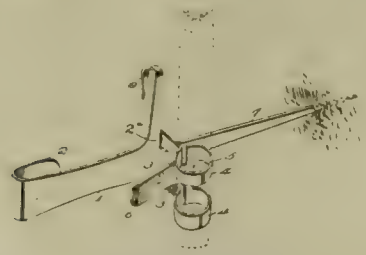
Candelaria, Nevada, Feb. 4, 1894.

On Claim 15 Above Discovery (at Lat. 64° 59′ North) on Ophir creek, 85 miles from Nome, Alaska, four pans of dirt yielded 70 oz., or $1250, and one single pan gave 25 oz. of gold.

MINING AND METALLURGICAL PATENTS.

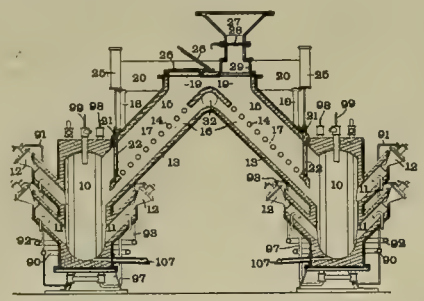
Specially reported for the MINING AND SCIENTIFIC PRESS.

CANDLESTICK.—No. 904,732. William Stephens, Ironwood, Michigan.



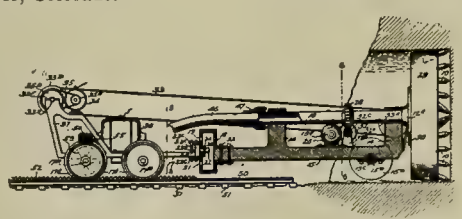
A device of the character described constructed of an integral sheet of metal and comprising a handle returned upon itself at its rear end and vertically enlarged at its other end to form a cross piece that is extended upwardly and returned upon itself to form a downwardly facing hook, a prong extended forwardly from the cross piece, laterally disposed strips extended from the cross piece above and below the prong and having their ends curved to form split rings constituting a candle socket, a cross bar connecting the extremities of the strips, and a finger piece extended from the cross bar and passing between and beyond the extended strips.

PROCESS OF SMELTING ORES.—No. 891,630. Frederick L. McGahan, St. Louis, Missouri.



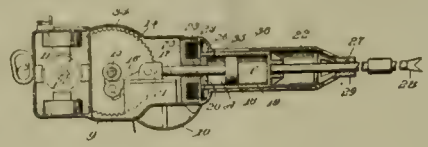
The process of smelting ore, which includes heating the ore in contact with a combustible, so as to liberate gases and other volatile products, withdrawing said gases and other products, adding steam to said gases and other products, subjecting the admixture to a temperature high enough to partially dissociate said steam, and returning the resulting aeriform body to the smelting zone of the furnace.

TUNNELING-MACHINE.—No. 900,950. Olin S. Proctor, Denver, Colorado.



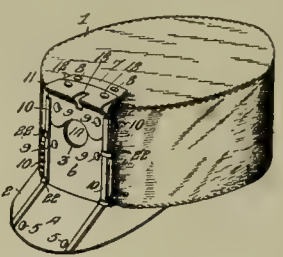
In a rotary tunneling machine, the combination of a supporting frame, a tubular shaft revolubly mounted on said frame, a rotary cutter head secured to one end of said tubular shaft, a plurality of operative rock-drilling engines arranged to cut the breast area of a circular tunnel, said cutter head having ports leading from said tubular shaft to said rock-drilling engines, means including a motor for rotating said tubular shaft and cutter head, means for connecting the opposite end of said tubular shaft to a supply of suitable drilling engine actuating fluid, a muck catching cylinder on said supporting frame surrounding said cutter head, and means for conveying the muck from said cutter head and cylinder to the opposite end of said supporting frame from said cutter head.

ELECTRIC PICK MINING-MACHINE.—No. 903,508. Alfred Sandstrom, Chicago, Illinois.



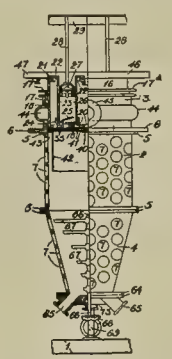
In combination, a reciprocatory tool, a motor, means operated thereby for producing a pneumatic drive and including a cylinder and piston movable relatively to each other, to the movable one of which parts the tool is connected, and releasable engaging means for the movable part adapted to allow the release and forward drive of the tool when the air pressure overbalances the hold of the engaging means.

ATTACHMENT FOR MINERS' CAPS.—No. 905,682. William Firman, Ottumwa, Iowa.

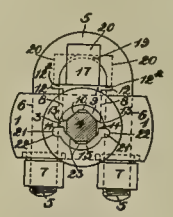


A lamp holding attachment for miners' caps embodying a supporting plate, a match receptacle disposed upon the rear side of said plate, said receptacle being open at one end and closed at its opposite end and formed with upper and lower longitudinal flanges and an end flange at its closed end, such flanges bearing against the plate, and fingers formed upon the ends of the top and bottom flanges and bent into interlocking engagement with the side edges of the supporting plate.

CONTINUOUS FILTER-PRESS.—No. 905,129. Alexander J. Arbuckle, Johannesburg, Transvaal.



No. 905,129



No. 903,948

In filtering apparatus, the combination of a vessel and a piston reciprocal therein, said piston carrying filtering means, means for removing the separated liquid from the piston and means for obtaining the flow of a portion of the separated liquid through the filter in a direction opposite to that of the filtering flow.

ROCK-DRILLING MACHINE CHUCK.—No. 903,948. Lewis C. Bayles, Johannesburg, Transvaal.

In a rock-drilling machine chuck the combination of the head and U bolt with a half bushing positioned in the bore of the head and non-rotatably retained therein by longitudinal projections engaging corresponding longitudinal grooves, as set forth.

Publications Received.

Any of the books noticed in these columns are for sale by or can be procured from the MINING AND SCIENTIFIC PRESS.

RESERVOIRS FOR IRRIGATION, WATER-POWER AND DOMESTIC WATER-SUPPLY. By James Dix Schuyler. 2d. Ed., revised and enlarged. Large 8vo., pp. 573, Ill., Index. New York. John Wiley & Sons. 1908. Price $6.

Mr. Schuyler's experience has been so large in arid countries that he presents a particularly full review of the problems of constructing and maintaining dams and reservoirs under the trying conditions so commonly met in the West. The book is not an engineering treatise, but a discussion of actual cases arising in practice, and the means adopted to deal with them. It thus supplies a need felt by every engineer in giving such a bill of particulars as no theoretic consideration of difficulties can properly cover. In this book are collected details of more dams than will be found discussed in any other treatise, and the profuse illustrations elucidate the text. There are 387 cuts and plates, 234 of which the publishers' announcement declares to be new. The utilization of hydraulic methods for making fills is explained in great detail, as also are the methods of rock-fill construction, masonry, earthen embankment, and the more recent adaptation of steel in all-steel dams, and in reinforced concrete. Sedimentation in reservoirs is reviewed, and the effects show that the difficulty is not as serious as had been anticipated, even under such severe circumstances as those existing at the Sweetwater dam in San Diego county, California. The total filling there has been 900 acre-feet since the work was completed in 1888. The solids deposited show an average of 1% for the total water passing through the reservoir, and the fact is adduced that the thickness of the deposit has varied almost directly with the depth of water. An interesting account is given of a mine-dam in the Curry mine at Norway, Michigan, which sustains a pressure of 277 lb. per sq. in., the static head being 640 ft. The work is one of great interest to engineers, and should appeal likewise to intelligent laymen.

HANDBOOK FOR FIELD GEOLOGISTS IN THE UNITED STATES GEOLOGICAL SURVEY. By C. W. Hayes. 8vo., pp. 159, Ill., Index. Washington. Published by the Survey, 1908.

This little pocket volume is something more than a mere list of what to observe, but even as such it is invaluable. It will serve as mnemonics to save the field geologist from omissions in collecting data. Beyond this useful function it undertakes to explain how to collect the notes needed to interpret the salient geologic features in an areal survey. For example, it details the kind and method of observation needed for determining the thickness of inclined strata from the outcrops; how to observe and plot the position of a fault-plane; how to determine the character of volcanic phenomena, whether dike, laccolith, sill, or other form; and how to collect and record proper data concerning rocks. The book will be a great aid toward system and uniformity of method among field geologists. It should be in the hands of every man having to observe and interpret geologic fact in the field.

MINERAL PRODUCTIONS OF CALIFORNIA FOR 1907. Bulletin No. 53 of the California State Mining Bureau. A valuable feature of the pamphlet is the series of county maps, showing all railroads and stage-roads, with distances between stations.

PRELIMINARY REPORT ON THE MINERAL RESOURCES OF OKLAHOMA. By Chas. N. Gould, L. L. Hutchison, and Gaylord Nelson. Bulletin No. 1 of the Oklahoma Geological Survey.

MINE SAMPLING AND CHEMICAL ANALYSIS OF COALS. tested at the U. S. Fuel-Testing Plant, Norfolk, Virginia. By John S. Burrows. Bulletin No. 362, U. S. Geological Survey.

THE MAGNESITE DEPOSITS OF CALIFORNIA. By Frank L. Hess. Bulletin No. 355, U. S. Geological Survey.

Commercial Paragraphs.

The WESTINGHOUSE ELECTRIC & MANUFACTURING Co. has again become the property of the stockholders, after having been in the hands of receivers since October 23, 1907. The petition for the discharge of the receivers was made on December 5, in Pittsburg, before Judge Young of the United States District Court of the Western Circuit of Pennsylvania, and was immediately signed by him. G. B. Gordon made the address to the Court, in which he gave a statement of the company's affairs prior to the receivership, explained the causes which led to the establishment of the receivership, presented a report of the operation of the company during the tenure of the receivership, and finally led up to the great work which has been accomplished within so short a time by Mr. Westinghouse and the various committees in bringing about the rehabilitation and re-organization of the company. He emphasized the fact that during the year the receivers had been in charge they had not only succeeded in paying off the interest on the bonds, as it fell due from time to time, but that they also kept the large factories of the company in operation during the entire time, doing an excellent business at a net profit of over $1,000,000. The action of 5000 employees subscribing for $600,000 of stock of the company was another feature presented to the Court. It was also brought out that the company under the re-organization would in every way be in a better condition than at any previous period in its history, as it would start upon the new regime with cash on hand amounting to more than $15,000,000, with an indebtedness of only about $200,000.

The DEARBORN DRUG & CHEMICAL WORKS announces that Herbert E. Stone has been made manager of sales in the Eastern department, with headquarters in New York. Mr. Stone was formerly president of the N. A. S. E., and recently manager of the Pittsburg office of the Chapman Valve Company.

The WOOD DRILL WORKS, of Paterson, N. J., has appointed the Harold L. Bond Co., of 140 Pearl street, Boston, Mass., as its exclusive agent for the sale of Wood rock-drills in the New England States. The Harold L. Bond Co. also has offices at 42 Broadway, New York, in charge of Joseph C. Sealy.

The LAIDLAW-DUNN-GORDON Co. has recently closed a contract with the Stewart-Kerbaugh-Shanley Co. for a large compressor-plant to be used in connection with the latter's 14-mile contract on the Catskill Mountain aqueduct to supply water for New York City.

CHALMERS & WILLIAMS advise that they have recently received an order from the Socorro mines, Silver City, New Mexico, for a 30-stamp mill, including a 48 in. by 18 ft. tube-mill and two 48 in. by 25 ft. Burt rapid cyanide filters.

The FRED M. PRESCOTT STEAM PUMP Co., of Milwaukee, Wisconsin, has opened a district office in the City National Bank Bdg., at El Paso, Texas, to cover the growing business of the Southwest and Mexico.

WHITE & NEWCOMB, of Mexico City, have the contract to erect the 12 Brown agitating tanks and 18 solution tanks, all of steel, for the Esperanza Mining Co., at El Oro, Mexico.

The HAMMOND IRON WORKS, Warren, Pa., has opened an office in Mexico City, Mexico, at Cinco de Mayo 32, Francis E. Pratt being in charge.

Catalogues Received.

The FORT WAYNE ELECTRIC WORKS, Fort Wayne, Indiana, has lately issued 'A Practical Guide for Transformer Testing', which should be a great help to those having such testing to do.

The NATIONAL BRAKE & ELECTRIC Co., Milwaukee, Wisconsin, has recently issued a pamphlet discussing 'air-compressors for industrial service'. It is called Publication No. 386.

The WESTINGHOUSE ELECTRIC & MFG. Co. has recently published an attractive booklet descriptive of its Type S distributing transformers.

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EDITORIAL.

DUPLICATION of work and needless expenditure of the public money is incurred by lack of co-operation between the departments of the Federal Government. The Land Office and the Geological Survey are both in the Department of the Interior, yet the first sends a geologist to examine a district, in order to delimit mineral-bearing areas, after the Survey has had a corps of men in the same district for two years. Uncle Sam is an extravagant old gentleman.

IN OUR LAST issue we published a letter from Mr. J. R. Finlay expressing disagreement with conclusions appearing recently in these columns. It was a pleasure to publish Mr. Finlay's letter; for careful criticism is more welcome than casual compliment. The views expressed by him will doubtless be shared by many other thoughtful men, and while they are contrary to the opinions we hold, the subject is one well worthy of full discussion. We hope others will contribute, more especially those who disagree with the editorial appearing in our issue of October 17. Mr. Hammond ought to take part and defend his position.

ALASKA owes much to the United States Geological Survey. The geological investigations have been exploratory in character and have been done under great physical difficulties; they constitute today the best source of information both for those resident in the country and for those having a financial interest in the mining operations. Further, the interim reports of progress and development, issued from time to time by Mr. Alfred H. Brooks and his assistants contain much valuable information, the excellence of which is best appreciated by those who know Alaska. We trust that this good work will obtain cordial legislative support at Washington.

HOW MANY people were misled by the advertisement of the Standard Oil Company, through its Assistant Secretary, protesting and warning the public against the imputation that the company or its controllers are interested in smelting, cotton, or other industrial schemes? The public is asked in this advertisement to give no credit "to any statement regarding the Standard Oil Company's views, acts, or intentions unless the same be duly vouched for by an executive official of the Company or by its designated attorneys." What an impudent notice! The records of the courts show that the Standard Oil Company and the predatory persons in control of it have for many years succeeded in killing competition by buying into subsidiary concerns; under various

guises they have tricked their competitors, fooled the public, and suborned railroad officials. No one is to believe that a clever and unscrupulous lot of men is interested in schemes of any kind unless the affidavit of an "executive official" is forthcoming! And yet a number of people will be impressed by this hocus-pocus. Among them our readers should not be found.

ON ANOTHER page we publish the concluding portion of the text recording the discussion held before the Pacific Coast division of the Mining & Metallurgical Society of America in November last. The account as now printed has value as the transcript of a serious conversation between experienced men; it may have the faults of an off-hand debate, but it has the merit of sincerity; and that outweighs all minor blemishes. In a technical society the one unpardonable sin is to "soliloquize under your sombrero" or "talk through your hat"—in plain English: to say, for the sake of effect, what you do not believe. The sequel to the discussion will be published in this journal at an early date. As far as can be judged, the result will be the crystallization of ideas on an important subject.

TECHNICAL men can help themselves and those whom they address by using technical words correctly. It is a strange fact that engineers graduated from universities will speak of "stratas that prospect," of "this data," of a "lense of ore," and of "partially developed ore." Most of our readers will plead 'not guilty' and therefore will not feel hurt by the mention of such lapses. The one last quoted is frequent. We remember a man who announced at the beginning of an article that it was to be a "partial" history of a Mexican mining district; that was not what we wanted; it was the unprejudiced story for which we prayed. 'Partially' and 'partly' perform separate services and signify different ideas; let us add to the significance of language by using the right word in the right place.

ONE of our local vehicles of misinformation, usually styled a morning newspaper, recently published a sensational account of "hot shot falling from the clouds." In a despatch imputed to the Associated Press, the reader was informed that "molten rain falls on the housetops of the peaceful town of Santa Cruz." A woman named Mrs. Burns is stated to have seen "little white threads of smoke rising from the roof where these little red-hot metal globules struck the damp boards. . . . This molten rain continued from about 2 o'clock to 4 o'clock in the afternoon." As a scientific explanation, it is suggested that "this molten precipitation is due to the condensed fumes from the Mt. Etna eruption." There is more of this childish twaddle, but what has been quoted suffices to illustrate the enlightened character of journalism in San Francisco.

FEDERAL aid to State mining schools has been frequently urged, and was recently recommended by formal resolution of the American Mining Congress at Pittsburg. Weakness in educational facilities is a sad characteristic of many struggling institutions established under the impetus of the Land Grant Act some years ago. The United States has followed this by extending material aid and dignity to the agricultural colleges, which were also beneficiaries by the Act, through affiliation with the work of the Agricultural Department by the creation of Experiment Stations. Under the proposed new Mining Bureau something of like character may arise in connection with the mining schools as a convenient way of enlarging the technological activity which the Bureau is expected to absorb from the Geological Survey.

State Mining Legislation.

At the last session of the California Legislature a bill was introduced in the Senate, known as Senate Bill No. 55, which had for its purpose the supplementing of the Federal mining laws, providing for the manner of locating and recording mining claims. After amendment in committee and elimination of certain objectionable features, to which we invited attention in our issue of February 2, 1907, the bill passed both houses and reached the Governor in the closing days of the session. It failed of approval by reason of the pressing nature of other matters requiring his attention. This bill, substantially in the form in which it passed the last legislature, has been reintroduced at the present session by Senator Henry M. Willis, and is known as Senate Bill No. 32. As we have frequently had occasion to point out in the columns of this journal, California is the only State in the Union possessing public mineral-bearing land that has not a code of laws governing the subjects embraced in the pending Willis bill. There is no law in this State providing for the manner of locating or recording mining claims. While the locators as a rule, through custom and habit, take the steps in perfecting locations provided for in the bill, there is no statutory sanction for them, and recorded notices have but little value as evidence before the courts.

The Willis measure is little more than an effort to express in statutory form the practice common in the mining regions of the West. There are no radical changes in the customary law, and the lines of the proposed legislation have their counterparts in every mining State in the West where public lands exist.

Briefly, the subjects dealt with are: (1) The contents of the posted notice, the requirements being extremely simple. (2) The marking of the boundaries without specifying the kind of stakes or monuments, in which respect the bill is simply a re-statement of the Federal law. (3) The recording of a copy of the posted notice with the County Recorder within thirty days after its posting, and making recorded notices or certified copies evidence in all proceedings. (4) The manner of making placer locations on both surveyed and unsurveyed public lands. (5) The method of locating, marking, and recording tunnel and mill-sites. (6) The amendment of faulty or defective locations. (7) The privilege of having

location boundaries surveyed by Deputy Mineral Surveyors and making such survey *prima facie* evidence. (8) Providing for proving by affidavit the performance of annual work. (9) Procedure by a co-owner who performs the work, to secure contribution from his associates, and prescribing the method by which the interest of the delinquent co-owners may be forfeited.

Most, if not all, of these provisions have been in successful operation in other States, they have received the sanction and approval of the highest State and Federal courts and the Land Department, they form a simple and safe guide to the miner, and give to his location notice, when once recorded, the value of a paper title, upon which all subsequent proceedings, either for patent or transfer, may be predicated.

There are two provisions of the bill, however, that require modification. Section 1426C of the bill provides: "The location of a placer claim shall be made in the following manner: By posting thereon, upon a tree, rock in place, stone, post, or monument, a notice of locators, date of location, number of feet or acreage claimed, such a description of the claim by reference to some natural object or permanent monument as will identify the claim located, and by marking the boundaries so that they may be readily traced; *provided*, that where the United States survey has been extended over the land embraced in the location, the claim may be taken by legal subdivisions and no other reference than those of said survey shall be required." There is an ambiguity in this section. The Supreme Court of California has held that when surveyed lands are located under the placer laws, there is no necessity for marking the boundaries, and this is the rule followed by the Land Department. This section as it stands leaves room for doubt as to whether such a claim should be monumented or staked. The reference to the sub-division of the public surveys is stated to be sufficient as a matter of description in the notice without other reference. But nothing is said concerning the necessity for marking the boundaries. An amendment to this section is suggested, in order to remove the ambiguity, by adding the following: "and the boundaries of a claim so located and described need not be staked or monumented. The description by legal subdivisions shall be deemed the equivalent of marking."

Section 1426r. is as follows: "The provisions of this act shall not in any manner be construed as affecting any mining district in the State of California, or as requiring a compliance with the provisions of this Act as to the location of mining claims within such district, where such district comprises one county, and the recorder of such district is the recorder of such county."

There is a strong suggestion of unconstitutionality in this section. It has been intimated that it violates the provision of the Constitution that all laws of a general nature shall have a uniform operation. There are possibly two counties in the State, Tuolumne and Nevada, which for a great many years have constituted separate mining districts. As such districts, they have rules and regulations providing for recording and other details of location, not, however, as we understand it, in serious conflict with the provisions of the Willis bill. By the act of the Legislature of 1897, all mining districts in the State were abolished. While this Act was repealed, such repeal did not revive these district organizations. Be that as it may, this method of placing two counties in a class by themselves and exempting them from the operation of a law which is of a general nature is not such a 'classification' as will overcome the objection of non-uniformity. It is possible that the unconstitutional features of this section might not destroy the entire bill, yet it is unwise to retain this feature, as it may afford ground for attacking the entire measure. With this provision eliminated, and there is no substantial reason why it should not be, the measure is wholesome, is distinctly in the interests of the mining industry, and should be passed.

Panama Canal.

Congress recently appointed a special committee of its members to visit Panama, with some hint at duties of inquiry, investigation, or the like. These gentlemen, in obedience to a psychologic law, will henceforward take keener interest in all that relates to Isthmian affairs. So much of good conceivably may arise from junketing expeditions: they inoculate the travelers with the virus of receptivity for information, and stir conceit to display superior wisdom. Whether or not they discovered the financial distress in which the Panamanians are languishing, they will be better able to appreciate and interpret to this country the formal protest by representative business men and bankers against the indiscriminate sale of supplies from the Canal Commission's stores, a practice which has nearly destroyed the commerce of the toy Republic. Uncle Sam has played so carelessly with the toy that he has seriously damaged its condition. What President Roosevelt will do with the protest remains to be seen. It deserves public answer, for back of it lies something more than a clamor for better opportunity to make money; the machinery of Government is said to be not satisfactory, and the restrictions upon free commercial intercourse with Colombia are detrimental to Panama in high degree. Whether this be the conviction of a majority is of course open to question, but the rumblings indicate a large party favorable to re-absorption into Colombia, the mother country. A treaty of amity and commerce has just been negotiated between the United States and Colombia, in which the independence of Panama is recognized. After this graceful act of a wronged nation, it would be a salve to our own honor and self-respect to authorize a plebiscite in the little Republic to determine whether it should retain autonomy, or return to the old allegiance. Our interests in the Canal Zone will rest as securely under treaty with Colombia as with Panama. We would not then be stultified by equivocal and farcical arrangements that give the lie to those principles on which our institutions were established. Now is the time for us to remove the blot from our escutcheon.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

H. C. Hoover is here.

Seeley W. Mudd is at St. Louis.

Harry H. Webb has gone to Carlsbad.

A. C. Beatty has returned to New York.

Curtis H. Lindley is at Globe, Arizona.

Spencer Penrose and Charles M. McNeill are at Salt Lake.

Allen H. Rogers is examining the Braden copper mine, in Chile.

H. Foster Bain attended the meeting of State Geologists at Baltimore.

C. W. Lininger is superintendent of the Amparo mine, in Jalisco, Mexico.

Latest Market Reports.

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

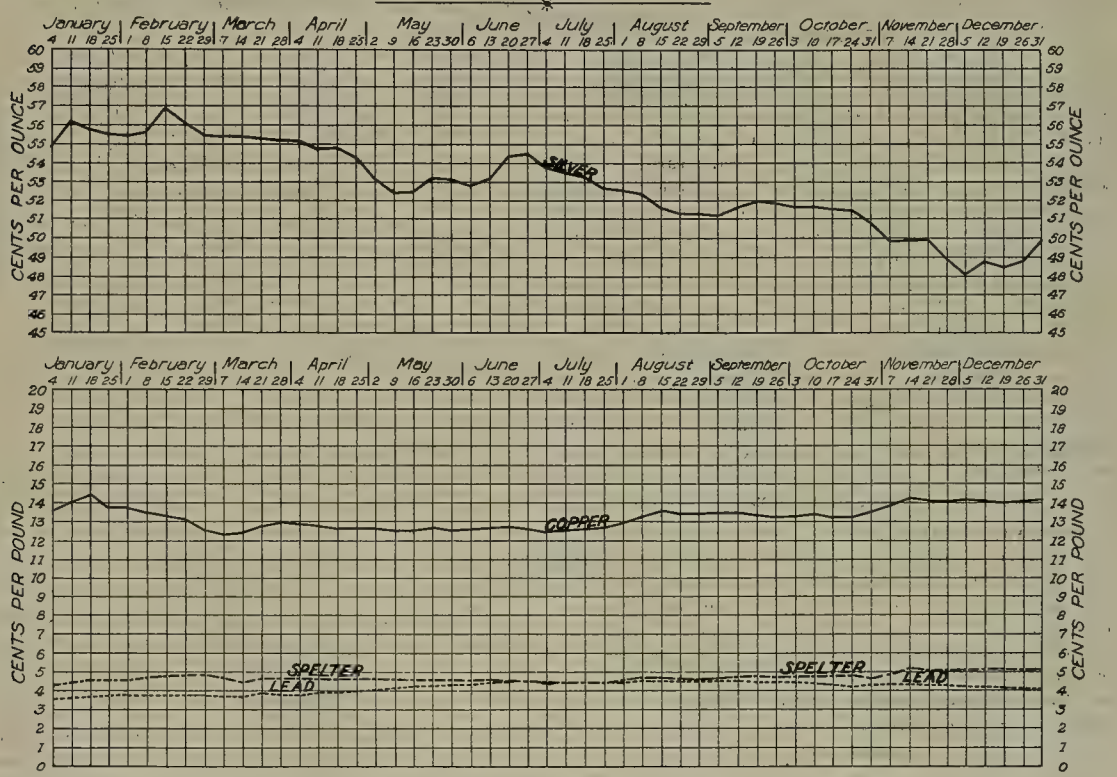
Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Jan. 8	14.25	4.17	5 17	51¼
" 9	14.25	4 17	5.17	51½
" 10	Sunday.	No market.		
" 11	14.25	4.17	5.17	52⅛
" 12	14.18	4.17	5.15	52½
" 13	14.18	4.17	5.15	52⅝
" 14	14.12	4.17	5.15	52⅛

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Jan. 7.	Jan. 14.
Amalgamated Copper	84⅜	80¼
American Smelting & Refining Co.	89	84⅝
Boston Copper	16½	15⅜
Butte Coalition	26⅝	25½
Cumberland Ely	8	8⅛
Dolores	6½	6⅞
El Rayo	3⅜	3¾
Giroux	7	8½

Graphic representation of Average Weekly Prices of Silver, Copper, Spelter and Lead during 1908

Compiled from Market Reports of Mining and Scientific Press.



Obituary.

Frank Taylor died in London on December 27, 1908. Since the retirement of his brother, John Taylor, a few years ago, he was head of the firm of John Taylor & Sons. He did not have much to do with mining operations, but gave his special attention to the business of the Sandycroft foundry, near Chester, which is owned by the firm.

Almarin B. Paul died in San Francisco on January 12. He was born at Bridgton, New Jersey, and was 85 years of age. A pioneer of mining in California, he made a specialty of the saving of fine gold. He built the first mill in the Grass Valley district and was an active mine operator on the Comstock. His last operations were in Shasta county. As a contributor to this journal, as a practical millman, and as a participant in all the early developments in California, he was a notable figure, and his passing is widely regretted.

Greene-Cananea	12¼	11½
Indiana Sonora	4½	4¾
La Rose	6⅜	6½
Miami Copper	15	14
Nevada Consolidated	18⅜	19¼
Newhouse	5⅝	5¼
Nipissing	9⅞	9¾
Ohio Copper	6⅜	6⅛
Tennessee Copper	47¼	44
Utah Copper	46¼	45¼
Yukon	4⅜	4⅜

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, January 14.

Atlanta	$ 15	Gold Kewenas	$ 24
Belmont	85	Laguna	1.10
Booth	25	MacNamara	37
Combination Fraction	1.17	Montana Tonopah	75
Daisy	62	Rawhide Queen	45
Fairview Eagle	25	Sandstorm	20
Florence	4.37	Tonopah Extension	45
Goldfield Con	7.95	West End	35

(By courtesy of W. C. Ralston, 353 Bush St.)

General Mining News.

ALASKA.

B. A. Chilberg and John Brower have purchased the King Solomon, Queen of Sheba, and Happy August claims on Newton gulch previously owned by August Homberger and Mike Young. The properties are those over which there was so much excitement during the past summer. They contain that wonderful decomposed ore which assayed so high and which gives such promise of being one of the greatest mines in Alaska! The consideration for the sale of the claims was $200,000. The most important part of the deal, and the one which means much to Nome and this district, is the fact that the new owners of the property are now arranging for the establishment of a large mill on the ground and the installation of 20 stamps. All of it will be completed and in working order by the first day of next August.——A discovery of pay gravel 500 ft. north of the third beach line at Nome, by Holt, Loveway & Ryan, is said to make the existence of a fourth beach practically certain. The streak is 8 ft. deep and pans run from three cents to three dollars.

ARIZONA.

GRAHAM COUNTY.

The Shannon Copper Co., which recently secured the Weaver mining claims, in the Greenlee district above Clifton, has established a camp and is now working a good force of men on the property. Several years ago Mr. Weaver struck good ore on the property, but the grade was not high enough to work on a small scale. Several mining engineers have reported on the property and the company is doing its work upon first-class advice. The entering of the Shannon into that part of the district means a great deal for individuals owning property in that neighborhood, and if development work on the Weaver claims proves successful, there will be considerable activity in the upper country.——The cable for the New England & Clifton aerial tram arrived last week and was immediately transferred to the mines. Construction work on the tram is progressing rapidly and it will not be many weeks until it will be in running order.

MARICOPA COUNTY.

The news of a sensational gold strike on Kirkland creek has been going about the last few days. It is reported that a vein of exceedingly rich ore has been discovered near the Rudy ranch in Kirkland valley and that a number of claims have been staked off.——It is reported that R. C. Vincent, president of the Duluth-Arizona Mining Co., will soon arrive at the company's property at Black Rock and start work on that promising group. A compressor, pump, and drills will be installed.

MOHAVE COUNTY.

The work of sinking below the 200-ft. level of the Ellen Jane mine, on Music Mtn., is to be started soon. The property is owned by the Nevada-Arizona Mines Co., of which T. J. Grant is superintendent.——All equipment has been placed on the Holy Moses mine by L. Hoffman and the work of timbering up the shaft is under way. Sinking will be commenced in a few days.——Frank Hare, W. P. Eshom, and J. W. Cornelius have made a big strike on a mining claim in the neighborhood of Potts Mtn., near the old McCracken. The vein is 15 ft. wide, with a solid body of ore 8 ft. wide running through it. This ore runs high in copper, gold, and silver. Pannings from the shaft run from $50 to $100 per ton in gold.——The Stockton Hill Mining Co. is arranging its affairs for the early resumption of work on the Cupel mine, at Stockton hill. It is probable that the shaft will be sunk several hundred feet deeper and the contiguous veins thoroughly explored.——The Altata mine is to be taken over by a new corporation, recently formed in Chicago. Mrs. Anna Tofte, one of the principal owners in the mines, is in Chicago, conferring with the other corporators in the perfecting of arrangements for the early resumption of work on the mines.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The Bernhardt group of claims on Green Lake Mtn. was the scene of a rich strike a few days ago. In putting down a shaft to a depth of 15 ft. an 8-in. streak of galena ore was cut that carries 72% lead and 15 oz. silver per ton. A contract has just been awarded for the driving of an adit for 250 ft. to cut under the shaft workings at an increased depth of 250 ft. This property is operated by a pool of Georgetown business men, headed by H. W. Kirby.——The Sigafoos boring machine just installed at the Georgetown adit on Columbian Mtn. was put into commission today. The machine seems to be breaking the rock at a good rate of speed, but until the tests have been continued for several days the complete results will not be known. A number of directors of the American Rotary Tunnel Machine Co. arrived in camp yesterday and all announce themselves as being more than satisfied over the results so far accomplished. Two weeks are to be allowed in which to demonstrate the worth of the machine, and if the work can be performed as claimed by the in-



Western Colorado.

ventor, a contract will be entered into with the Georgetown M. P. & T. T. Co. for the breaking of 16,000 ft. of ground. A great many operators from various parts of the State are now on the ground witnessing the tests.——H. J. Vancil, of Joplin, Missouri, president of the Joplin T. & M. Co., arrived in camp this week and is now making arrangements for starting work on the 150-ton chlorination plant which is to be built on Clear creek near the portal of the Joplin adit. Plans are being drawn and within from 30 to 40 days actual work will be under way. The mill is to be fed upon ores from the Gambetta vein, where immense bodies of lead-zinc ore are exposed, while contracts will be made for the treatment of a good tonnage of ore from the various mines lying in close proximity. B. J. O'Connell is manager.——Within a short time development is to be started upon the holdings of the East Argentine M. M. P. & T. Co., in East Argentine. For the present the Sidney adit will be driven forward with hand-drills, but as soon as sufficient water is flowing the compressor plant will be used. The Sidney adit is now in Pendleton Mtn. 2300 ft., and from surveys the White, or Mother Lode of that section will be reached within from 125 to 150 ft. Lessees at work on the Ontario vein, cut 2125 ft. from the entrance of the adit, are sending out heavy shipments of smelting ore, worth from $55 to $70 per ton in silver and lead. M. Sidney is manager.——The Toledo M. & M. Co. is pushing development work. The adit has now

passed the 400-ft. point and from surveys just made the Toledo vein will be reached within from 40 to 50 ft. The management purposes driving upon a vein recently passed, as a streak of galena is exposed that is from 6 to 12 in. wide, which is said to assay more than $60 per ton in silver and lead. G. S. Redd, of Denver, is manager. This company intends to install a plant of machinery in the early spring.——Clapper & Co. has taken a lease upon a big block of ground in the Scepter adit, and the property is now being placed in position to permit of stoping. At the point where operations are being centred, a body of lead-zinc ore is exposed for 150 ft. that is 8 to 20 in. wide, while occasional streaks of smelting ore are found that carry as high as 406 oz. silver per ton. The lead-zinc is to be brought to Georgetown for separation at the custom mills.——The Astor-Stewart M. & M. Co. has started work in the re-timbering, enlarging and reducing the grade of the Scepter adit. It is expected to have this undertaking completed within from 30 to 40 days. H. G. Houseman, of Denver, general manager, has been in the East for the last three weeks and advises that large funds have been pledged for the carrying of all plants to a successful issue.——The new 25-ton mill at the Black Eagle mine, situated up Chicago creek, will be started some time during the next two weeks. This is the first plant of its kind ever constructed in either Clear Creek or Gilpin counties, being equipped for chemical-electric extraction. The compressor just put in near the collar of the shaft is running night and day and a heavy tonnage of ore is being mined. The fourth and sixth levels are being driven eastward with the aid of machine drills, and as the ground is opened the showing continues to improve. The orebody on the sixth level is 8 ft. wide in places, and is worth from $5 to $22 per ton in gold. It is the intention of J. F. Puchert, who is manager, to shortly start work in deepening the shaft another 100 ft. The Black Eagle is developing into one of the heaviest producers of the Chicago creek district and effort is to be made during the present year for a record-breaking production.——The St. Paul M. & M. Co., controlling a big group of claims on Green lake and Payne's Mtn., is carrying on work in the last named region. The adit is being driven ahead and it is expected that another vein will be reached within the next few feet. Driving is to be started upon a vein recently passed, as a streak of galena is exposed that is from 4 to 6 in. wide. It is understood that this company will shortly resume work in the advance of the St. Paul adit on Green Lake Mtn. The bore is in 1400 ft., and by continuing it for 500 ft. farther the St. Paul vein will be intersected. R. H. Blackman is resident manager.

Georgetown, January 9.

LAKE COUNTY.

Work on the Tenderfoot shaft is progressing steadily, and the lessees hope to have it completed to the desired distance by the early part of the new year. It is now down 120 ft., which is 50 ft. short of the point to which it will be driven.——The Fanny Rawlings has opened a new vein of lead ore that promises to make good with further development. This discovery is in a virgin portion of the property, in which extensive explorations are now being carried on. In addition to this work the Fanny Rawlings is maintaining a steady output from the old workings, in which excellent gold ore was found in the year past.——Thomas Gilroy, who has secured a long lease on the White Prince and Across the Ocean properties on Breece hill, is working three men. He is now sinking a new shaft, and is expecting to get ore in the near future, as the well known orebodies of the Penn and Nettie Morgan mines run through the ground.——During the month of December the Yak tunnel broke all previous records for distance in the same length of time, cutting 358 ft.—about 11½ ft. per day. The breast is now in the Resurrection property, and will soon be in a position to tap the old veins that have already produced thousands of tons of good ore. During the present months the drills will be put to work to tap the old Resurrection shaft, which is now partly filled with water. This will be a task requiring much care and accurate calculation, as it is proposed to allow the water to flow out gradually, so as not to flood the tunnel. After the old shaft is drained, development work along the property held by the Resurrection can be carried out.

OURAY COUNTY.

A deal has just been consummated whereby the Camp Bird, Ltd., secures a one-year option on eight valuable mining claims on and near the Ouray-San Miguel county line, the purchase price for the property being named at $10,000.

TELLER COUNTY.

The Portland Gold Mining Co. has declared a dividend of 4c. per share, involving the distribution of $120,000.——The Jerry Johnson mine, on Iron Clad hill near Cripple Creek, has been leased to Edward Gaylord and associates, of Denver. A hoist is to be installed and power for the air-drills will be obtained from the Western Investment Co.'s John A. Logan plant, on Bull hill. Operations will shortly be resumed at the W. P. H. mill, of which milling plant Mr. Gaylord is manager, and the low-grade ores from the Jerry Johnson mine will be treated therein. The higher grades of milling and smelting ores will be consigned to the valley plants as heretofore.——An amicable settlement of the matters at issue between the Acacia Gold Mining Co. and the Findley Consolidated Mining Co. has been arrived at without recourse to litigation. By the agreement duly filed for record with the county clerk and recorder last week, the Acacia company is allowed exclusive and perpetual right to dump waste rock on a certain portion of the Shurtloff and Pauper lode mine cliams of the Findley company, the Findley company to have the right to remove and dispose of said dump as their own property. It is further agreed that the Acacia company shall protect the two shafts on the north end of the Shurtloff claim from filling up and damage from said dumping of waste rock. By the terms of the settlement the South Burns Leasing Co., operating the South Burns mine, will, or has already received a satisfactory cash payment, representing the net value of the ore extracted from within the lines of the Burns claim by the Findley company.——As a protective measure against fire a high-power fire-pump has been recently installed at the surface at the Henry Adney mine on Beacon hill, and similar pumps have been contracted for by other mining companies and lessees. The machinery at the Henry Adney is also being overhauled and it is understood that work on an extensive scale will be shortly resumed.

IDAHO.

SHOSHONE COUNTY.

(Special Correspondence).—With several strikes of importance and the declaration of dividends by the Bunker Hill & Sullivan and the Snowstorm mining companies the new year has opened most prosperously in the Coeur d'Alene.——After an idle period of almost a year, work is about to be resumed on the property of the Rhode Island Co., in the Osburn district. The property has been extensively developed and six feet of excellent ore opened up. It is the intention to sink a winze and if the results are up to expectations shipments will commence.——At the annual meeting of stockholders of the Hector Mining Co., held in Wallace about the beginning of the week, officers and directors were chosen for the ensuing year. John H. Nordquist is president. The report of progress is considered entirely satisfactory, contracts for 250 ft. of work having just been let.——A strike has been made on the property of the H. E. & M. Mining Co., consisting of two feet of clean shipping galena carrying 80% lead and over 20 oz. silver per ton. In addition to the shipping there have been several feet of good concentrating ore opened up. The property is in the Revenue Gulch district and a considerable amount of excitement has been caused by the developments.——After 18 years of steady labor J. Ward, an old-time miner of this district, has opened up an 11-ft. vein of free milling ore in the Ward's Peak district. The strike was made the beginning of the week and samples of the ore

which have been brought down to Wallace have given returns of $220 in gold. The ore was found at the end of a 900-ft. adit and at an approximate depth of 700 ft.——The Copper King mine and concentrator in the Thompson Falls district has changed hands and after an idleness of several years it is expected that both mine and mill will be started at full blast in the spring. The property, which was formerly owned by Fred M. Steele, of Chicago, has now passed into the hands of the Thompson Falls Copper & Milling Co., the consideration being $100,000. The new company is financed by Eastern men, but S. A. Hurlburt, of Thompson Falls, has been retained as general manager. The property is an old-time producer and has shipped much rich ore. It is believed that the machinery can be put in order at very little expense.——At the annual meeting of the Swastika Copper Mining Co., held last week, Thomas M. Marlowe, of Missoula, was re-elected president and treasurer; George E. Marlowe, of Wallace, secretary, and J. W. McDonald, of Superior, Montana, vice president and manager. A contract for 300 ft. of work was given to Thomas M. and George E. Marlowe. This will be done in driving a lower adit to intersect the main vein. It was decided to make no further shipments of ore until the completion of the Chicago, Milwaukee & St. Paul railroad some time in the spring. One car was shipped during the past winter and netted about $49 per ton, but the expenses of hauling were considered too high. An attempt will be made to get sufficient funds to erect a concentrator in the spring. It is the intention of the company to increase the capitalization from $150,000 to $7,500,000 in the near future. ——The Pittsburg Lead Mining Co., which has been idle for the past three months, will resume work this week with a force of 20 men. The men will be used in driving on the 200-ft. level and in sinking the shaft another 200 ft. Work at the property will be superintended by Sidney L. Shonts, of Wallace, under the direction of Stanly A. Easton, manager of the Bunker Hill & Sullivan.——An option on the stock of the Belmont Mining Co. has been given to a syndicate of Spokane capitalists. An inspection is to be made and, if present plans mature, work will be started at once.

Wallace, January 9.

KANSAS.

CHEROKEE COUNTY.

(Special Correspondence).—The development of greatest importance to the Galena camp is the opening of a 500-acre tract by the Clermont Mining Co., south of Galena. A large amount of prospecting has been done. The twentieth drill-hole has been completed showing ore from 134 ft. to 180 ft. The cuttings run from 9 to 10% zinc-blende with no galena showing. Prospecting was begun 16 months ago and has been kept up all through the panic. Several drill-holes penetrated a limestone bar and below this entered a rich deposit which continued to 300 ft. The ground is being leased, but the company will keep a 10-acre tract upon which the last strike was made for its own development. Shafts have already been started upon sub-leases and ore has been struck at 50 ft. in one shaft.——A rich strike of zinc-blende was made by Page & Co. west of the Wyandotte land. The ore was reached at 100 ft. and a 12-ft. face has been opened. It was upon these tracts that the royalty was reduced last summer with favorable results as an increased demand for leases was made and several strikes have been reported.——The largest and most important sale of ore in the Galena camp for the past year was recently made by Lynch & Williams. It consisted of 1000 tons of ore sold to the Cockerill Zinc Co.——A ventilating drift is being run in the Hartford mine to connect two shafts 325 ft. apart. The large new mill is being run only part of the time, as enough ore is not being produced. The new drift will furnish considerable ore and enable the plant to run longer. This is one of the largest mills in the Galena camp. The ore here is found at 170 ft. and is especially high grade.——In the Baxter Springs camp the Hannibal & St. Joe mine is being re-opened by George E. Ladd. A large pump has been installed.——The Joanna mine has been procured by Starchman & Caulkins, who have begun operations. Extensive improvements are under way.——At the Chicago-Quapaw mine a deep well is beink sunk, which is now down 615 ft. It is to be used to supply artesian water for the mill. During the drilling a large deposit of ore was penetrated from 62 to 85 feet.

Galena, January 9.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—Among the plants recently re-opened is the Church Mitchell mine in the Duenweg district. This is one of the largest plants in that district and has been shut down for seven months on account of low ore prices. A full force of men was put to work last week at advanced wages. The property is operating upon sheet ground.——The Hayseed mine in the Carthage camp is again producing after lowering the shaft to 155 ft. The company is cleaning from 7 to 10 tons of ore per day. The drifts are being further opened up. This property has been under development for several years.——The Plymouth Rock mine in the Sarcoxie camp has been taken over by a new company and has been started again after a long idleness. The new owners have overhauled the plant and made thorough preparations for steady production. Both day and night shifts will be run.——The Highland plant, owned by the United Zinc Co., will be re-built. This plant was destroyed by fire some weeks ago. The building was a completed loss, but the machinery was slightly damaged. ——The San Gabriel mill, which was moved from the Matthes Bros. tract in Duenweg to the same company's land in the Joplin camp, is now almost completed. The mill is now on the old John Jackson land, owned by Matthes Bros., and thoroughly developed by them during the past year. A shaft has been sunk and a good body of milling ore opened up. The plant has a capacity of 400 tons. It will mean a considerable addition to that portion of the Joplin camp.——W. E. Johnson has just completed a new tailing mill of 200 tons capacity on his land southwest of Joplin. It will treat the piles of tailing upon the land. A large amount of ore can be cleaned, as the mills for the most part were small and not equipped with sludge tables and the fine could not be saved. From 2 to 5% ore can be found in the tailing piles. Little lead is found, the ore being mainly zinc upon this land.——The Lucky May mill in the southwest part of the city has become a steady producer. The 200-ton plant is comparatively new. Since its completion a large amount of development has been done. The prospect was operated by hand-jigs before the mill was built. The deposit is found at 150 ft.——A new tailing mill of 200 tons per shift has been erected on the Cameron lease southwest of Joplin. Both tailing and sludge will be handled. The tailing of the Cameron mill will first be handled and later other tailing piles will be procured. The tailing of the Cameron mine runs from 2 to 5% zinc. The slime tables in the new mill are special devices for saving the very fine ore, usually lost on the ordinary concentrating table.——The best recent lead strike in the camp was made at Spring City in the U. G. Wilson shaft, which has been sunk 300 ft. from the old Argosy shaft. The ore is found at 130 ft. and the shaft and drifts are covered with the ore in a layer formation. The ground is not opened sufficiently to keep the mill running all the time. Development work is being hastened.——The Yellow Dog, the largest plant in the district, has been closed down some time. However, underground work has been carried on in the meantime and rich ore was struck in a stope at 200 ft. The ore was galena of a very high grade. It has not been ascertained whether the ore is merely a pocket or a large deposit. During the shut-down, the Yellow Dog mill has been thoroughly overhauled and rumors are afloat that it is to re-open soon.——Drilling on the Kelley land near the Frisco depot in Webb City has resulted in good strikes of sheet ore at the usual sheet-ore depth. The cuttings assay as high as 8 to 9% zinc-blende.——A shallow strike of ore has been made in the Oronogo camp by the Oronogo Circle No. 2. The ore was found at 80 ft., while the usual run of

ore occurs here at 150 to 200 ft. The 150-ton mill has only recently been overhauled. The plant will soon be operated with two shifts. A new revolving screen has been installed at this plant which has proved efficient in saving the fine.——A large centrifugal pump has been at work in the drifts of the Cock Robin mine in Chitwood and has drained the ground completely. The ground was worked several years ago and was a good producer, but has been filled so long with water that the sides of the drifts are mud covered and the extent of the ore cannot be determined. Development work will now be done.——The new mill on the Norment lease is completed and ready for operation. The plant is a 100-ton structure. The only drawback is the lack of water for running the mill. This is to be supplied from the old shaft and drifts of the Ready Money mine adjoining. A pump has been installed for this purpose.

Joplin, January 9.

NEVADA.

HUMBOLDT COUNTY.

The Cleghorn-Duke lease on the estate of the Seven Troughs Signal Peak Mining Co. is to be equipped with a full outfit of machinery and an extensive campaign of development is to be started. The equipment has arrived in Lovelock and is now being hauled out to the property. A 1400-ft. adit is to be started. John Cleghorn is general manager.——Good headway is being made in the sinking from the 200-ft. point to a depth of 400 ft. of the shaft on the property of the Monnette M. & M. Co., which lies just north of the estate of the Seven Troughs Mining Co. Sinking was resumed about a month ago and the shaft is now down to the 290-ft. point. It is expected that the 400-ft. point will be gained within the next 60 days, when a crosscut will be started to the west to strike the two big veins which have been opened up west of the shaft on the 200-ft. level.——The foundations for the Samuel Hains custom mill have been completed and the erection of the building started. Several carloads of machinery have arrived at Lovelock. C. S. Floyd, of Mazuma, is looking after the construction work.——Julius Lesher, of Oakland, will, it is reported, build a $14,000 hotel at Mazuma.——Stoping was begun last week on the rich shoot of ore that has been opened up in the north drift on the 200-ft. level in the famous Harris lease of the Seven Troughs Florence Mining & Leasing Co., on the property of the Seven Troughs Mining Co., preparatory to a test run of ore at the Kindergarten mill of the Seven Troughs Coalition Mining Company.



The Advantages of Rapid Transportation.

LINCOLN COUNTY.

The Copper King property, nine miles north of Searchlight, owned by Peck & Pauff, will be equipped with new machinery and extensive development started. There is already a shaft down 65 ft. and an adit 50 ft. long.——A new company, called the Lenape Gold & Copper Mining Co., has been incorporated under the laws of Delaware to work the Copperopolis group, directly south of the Philadelphia-Searchlight. J. Frank Allee, of Delaware, is president, and other officers are members of the directorate of Lawson's Bay State Gas. William B. Spitall promoted the deal and is authority for the statement that the machinery will be purchased and operations started in February.

NYE COUNTY.

The output of the Bullfrog district for 1908 is estimated to be $910,480, of which the Montgomery Shoshone produced $685,763.——Vandals attempted to destroy the ore-bins at the Mizpah shaft of the Tonopah Mining Co. Thursday of last week. Two charges of dynamite were exploded on the foundations, but failed to do any material damage. The motive of the perpetrators is not known.——The mines of Tonopah produced during the year 1908 a total of 286,926 tons of ore, estimated to be worth $7,433,585 (figuring the milling ore at $25 per ton and the ore sent to smelters at $60 per ton). Of this total production the Tonopah Mining Co. produced more than half, or 169,090 tons.——The production of the mines of Tonopah for the week ending January 9 amounted to 5518 tons, of an estimated value of $137,950.

STOREY COUNTY.

(Special Correspondence).—The Comstock lode is producing at the rate of $20,000 per week, of which fully $16,000 is coming from the Ophir mine. Most of the rest comes from the Consolidated Virginia.——At the Ophir ore is being extracted from the 2100, 2200, and 2300-ft. levels. The Ophir shaft is being repaired below the 1465-ft. point. On the 2300-ft. level the northeast and southwest drifts are progressing satisfactorily.——Ore running $41.31 per ton is being taken from the 2150-ft. level in Consolidated Virginia. Some repairing and development work is going on at different points.——Considerable low-grade ore is being developed in the Savage and is being stored on the second-class dump. The average content is about $4 per ton. It is coming from the Comstock Tunnel level.——The 1200-ft. level is being opened up at the Yellow Jacket and the surface tunnel is being repaired. The mill is running on fair-grade ore from the Crown Point mine.——On the 100 and 200-ft. levels of Silver Hill some fair-grade ore is being opened up and considerable development work is under way.——The lease on the Chollar croppings paid the company $620 in royalties during November.——A larger air-compressor and about 350 ft. of larger pipe has been placed on the 2475-ft. level of the Ward shaft to furnish a greater supply of air to the electric pumps. Several repairs to the shaft have been made during the past few days. Owing to irregularity of the electric power supply, mainly due to storms and the blocking of the Truckee river by ice, resumption of sinking has been deferred.——Rumors of a rich strike in the Confidence and of important discoveries at other properties are freely circulated here, but have not yet been officially confirmed.——At the present time the Comstock presents more scenes of animation than has prevailed for many years, due principally to the successful unwatering of the Ward shaft.

Virginia City, January 9.

WASHINGTON

FERRY COUNTY.

The King Mountain M. & M. Co., of Spokane, operating claims on the State road near Boyds, is receiving a complete new outfit for the property. The company will resume operations at once with a force of 15 for the mines, together with a cooking outfit and a gang of men to make a road from the property to the State road, a distance of two miles. S. S. Bailey is president and general manager.——The

Michigan Gold M. & M. Co., a close corporation, has purchased from Spokane men three claims, an extension of the First Thought mine, in the Orient district, for $30,000. The claims are known as the Climax, Moonlight, and Plutonic, and are on the extension of the famous First Thought lead. The property was purchased by capitalists of Michigan and Rosalia, there being 14 people in the corporation. No stock will be disposed of by the new company, which now has $15,000 deposited in a bank in Spokane to carry on development work. The property was sold by M. B. Grieve, John Argall, Frank Weatherwax, and William Moore, of Spokane. The company has ordered machinery to carry on its development work. This includes an air-compressor and two drills. An adit will be started as soon as the machinery is on hand, and will be run to strike the main lead, which is expected to be reached in about 200 ft. The company is planning to start work within 60 days.

CANADA.

BRITISH COLUMBIA.

Phoenix, in the Boundary district, made a record for ore tonnage in 1908, despite the curtailed activity in development. This has been due to improved shipping facilities and increased tonnages from the Granby. Boundary mines shipped more than 1,500,000 tons of ore in 1908, as compared with 1,148,237 tons in 1907, and 1,161,537 tons in 1906, practically all of which was treated at Boundary smelters. Economy in mining methods now is shown in the fact that Phoenix mines, just before the slump in copper, were employing 1000 men and shipping between 90,000 and 100,000 tons of ore per month, while today from 750 to 800 men are employed in the camp and the tonnages are greater. Phoenix is the great copper camp of Canada, by reason of having the largest output of copper ore, and the Granby is the big producer, the other companies being the Consolidated Mining & Smelting Co. and the Dominion Copper Co. Total shipments from the Granby mines were 1,056,000 tons, as compared with 613,537 tons in 1907, and 801,404 tons in 1906. The smelter treated more than 1,000,000 tons last year, as compared with 637,626 tons in 1907 and 828,879 tons in 1906. The shipments from the Dominion copper mines, shipping to the Boundary Falls smelter, last year were as follows: Brooklyn, 5780; Rawhide, 10,740; Sunset, 3802; Mountain Rose, 530; Athelstan, 120. The smelter treated 22,666 tons. The Snowshoe mine of the Consolidated company, which resumed operations in August, is shipping 600 tons of ore daily. The greater part goes to the company's smelter at Trail and the rest to Greenwood smelter. Since resumption the Snowshoe has shipped 48,826 tons. The B. C. Copper Co. is the second big copper producer in the Boundary, and since resuming last June has been conspicuously successful in its operations. Mother Lode mine is the big shipper of this company, and now runs close to 2000 tons daily. Since resumption in June it has shipped 321,899 tons of ore to the company's smelter. The other mine is the Oro Denoro, three miles from Phoenix, which shipped 66,800 tons in the seven months. The company also owns the Lone Star and Napoleon mines, in Washington. The latter is shipping 100 tons daily. The B. C. Copper Co.'s smelter at Greenwood has had a successful seven months' run, the furnaces consuming 400,000 tons of ore. Other mines in the Boundary contributing ore shipments during 1908 are the Sally, 108 tons, and the Crescent, 53 tons, both high-grade properties. One car of 21 tons from the Sally mine netted $3175 after paying all shipping and smelter expenses.

MEXICO.

OAXACA.

(Special Correspondence).—El Parian station, 60 kilometres north of Oaxaca, is the centre for a mining district of importance, there being some present activity. The Rio Seco, in charge of E. Chisholm, is preparing to erect a 10-stamp mill, with concentrating tables and cyanide vats. On this group are several parallel veins cutting through gneiss and schist, the ore being a gold-bearing quartz, having oxidized iron near the surface and iron sulphide at greater depth. There is 2200 ft. of development on one of the veins. It is claimed the oxidized ore will average ₱30 per ton, and that the sulphide ore will run 22 gm. gold in one vein, and 185 gm. in another vein. F. T. De Votie is president of the company.——The Santa Sofia M. Co. has a mine close to Caterina station, on the eastern slope of the Sierra Juarez. It is owned by two Boston men and is managed by Place & Elton of Oaxaca; the latter state that they have ore blocked out of the value of ₱200,000, that the ore carries free gold which occurs as an impregnation along the fracture planes of the country rock, which is gneiss. Associated with the ore is an iron sulphide. The mine is opened by adit levels. The plan is to erect a mill on the property this year. The proposed plant will probably have a crusher, rolls, Huntington mills, amalgamating plates, concentrating tables, and cyaniding vats. It is said the unsorted ore of the mine will average one ounce of gold per ton.——The Santa Caterina adjoins the Santa Sofia and is developed by 2000 ft. of work. It has a 5-stamp mill in operation, the extraction being effected by amalgamation, concentration, and cyanide treatment. Arthur Buttner is superintendent.——The Socorro, near Parian, is developed by a 200-ft. shaft and 1000 ft. of lateral work. The ore contains free gold that assays ₱10 to ₱100 per ton, and to treat it a 10-stamp mill is being erected, John A. Morris of Oaxaca being manager.——The San Martin, controlled by Frank M. Leonard and associates, is situated 35 miles south of Oaxaca, on the Oaxaca & Ejutta railroad. In the course of development it is shipping ore that brings in ₱5000 per month. The principal vein cuts through the diorite, and is 8 to 25 ft. wide. The ore contains silica 85%, copper 1, lead 2, zinc 2, iron 6, sulphur 7%. The shipping ore averages 80 gm. gold and 4 kg. silver per ton. The silver is mostly argentite, and the gold associated with it. There is said to be some sylvanite in the mine. The work is carried on through a 300-ft. shaft.——The Natividad, situated near the San Martin, is owned and operated by Manuel Mimiaga of Oaxaca. He operates a 20-stamp mill, having amalgamating plates and pans, handling 50 tons per day. It is reported that equipment will be installed for cyaniding the tailing.——Los Ocotes mine, south from the San Martin, belongs to the Tezuitlan Copper Co., the development being in charge of Thos. Skewes Saunders. In the course of the development, however, a large tonnage of copper ore has been shipped to that company's smelter at Tezuitlan, in the State of Puebla. The Ocotes is opened through a vertical shaft 650 ft. deep, with much driving on the vein. It is reported that the workings expose 200,000 tons of ore in the mine, running 5% copper and 200 gm. silver per ton. The equipment includes a steam-hoist, air-compressor, and a generator for electric light.——The Conejo Blanco, in Taviche district, is in charge of Fred Whittaker. It has a vein of great width, which assays well in silver and gold. It strikes through an andesite country and has a quartz gangue. It is said to be under bond to an English company. The San Francisco, in the same district, is owned by the Tehauntepec Silver Mines Co., represented by Judd Bros. of Mexico City. On the property are several veins, 4 to 10 ft. wide, with high-grade silver ore. Some shipments of hand-sorted ore have been made, but only development is now being done. The property is managed by E. J. Bumsted, and it is reported that a mill may be erected. It is owned by Juan Baights of Oaxaca, who ships regularly a sorted ore that assays 3 kg. of silver and 45 gm. gold per ton. The Escuadora is opened by a 400-ft. crosscut to the vein, on which there is 2000 ft. of development on one level. The ore is highly silicious, carries ruby silver, argentite, and some gold. The mine has been a producer for 10 years and is shipping now a small tonnage daily. It is owned in Oaxaca, and is in charge of Santiago Guzman.——The Oaxaca smelting plant is now in control of the Boston bondholders of the original company. It has one furnace for lead, and one for copper smelting, and is a well built plant. It is thought arrangements will be made to start it within a year. The Magdalena smelter, built for lead ores of the Magdalena mines in the Tlacolula valley, is under a receivership, the creditors being the Consolidated Metals Co. of Mexico City, having liens also covering the mines.

Special Correspondence.

WASHINGTON.

American Association for Advancement of Science. — Quartz Generated at Different Temperatures.—Geological Progress Meeting. —Study of Simple Sulphides.

Last week the centre of local interest was in Baltimore. At the meeting of the American Association for the Advancement of Science, the Geological Society of America, and various affiliated organizations, approximately 1500 scentific men assembled. Johns Hopkins University, most appropriately was the principal host, but the societies were scattered over the whole city, and many guests were entertained in Washington. The meeting was notable for geologists especially. With Thomas C. Chamberlin as president of the association, J. P. Iddings, the retiring, and Bailey Willis, the presiding vice president of Section E, and Samuel Calvin, the president of the Geological Society, a good meeting was assured. A long list of papers was read. The principal feature of the meeting was a symposium on correlation, participated in by Messrs. Van Hise, Adams, Walcott, Grabau, Weller, Girty, White, Williston, Osborn, Stanton, Dall, Arnold, Knowlton, Salisbury, MacDougal, and Chamberlin. This is the first time a comprehensive discussion of this subject has taken place since the 1891 meeting of the International Congress at Washington, and the papers presented served to show the greater growth of knowledge in the intervening time, while the great gaps were also brought out.

Papers on economic geology were not much in evidence, though J. T. Singewald, Jr., presented a brief summary of the results of an investigation of Maryland iron ores carried on last season for the Maryland Geological Survey. F. E. Wright and E. S. Larsen, under the title, 'Quartz as a Geologic Thermometer,' presented results likely to be of large use in a study of ore deposits. In brief, they said:

"Observations by Le Chatelier and Mallard in 1889-1890 proved that at about 570° quartz crystals undergo a reversible change, the expansion-coefficient, bi-refringence, and circular polarization all changing abruptly. O. Mügge (*Neues Jahrbuch, Festband,* 1907, 181-196) has recently considered the problem again in detail, and by means of etch figures, combined with crystallographic behavior on heating, found that below the inversion point quartz crystallizes in the trapezohedral-tetartohedral division of the hexagonal system, while above 570° it is trapezohedral-hemihedral. The high form is similar to the low form, and differs chiefly in the fact of its common planes of symmetry. A plate formed above 570° is trapezohedral-hemihedral, but on cooling it changes to the trapezohedral-tetartohedral division, thereby losing its common planes of symmetry, which may then become twinning planes. It is to be expected, therefore, that quartz crystals thus cooled will be irregularly and intricately twinned after (1010.), while low temperature quartzes are simple or regularly twinned. It is furthermore evident, on considering the genesis of quartz at different temperatures, that intergrowths of right and left-handed quartz are limited chiefly to quartz crystals formed below 570°. These two criteria can be used to distinguish quartz which has been formed or heated above 570° from quartz which has never reached that temperature. The object of the present investigation has been to test the general validity of the theoretical conclusions on a number of quartzes from different kinds of rocks and veins, as well as to determine more accurately the inversion temperature."

Californians will be interested in the election of David Starr Jordan to the presidency of the Association, and the authorization given the council to arrange for a summer meeting in 1910 in Hawaii, if conditions prove favorable. A hearty invitation had been extended by Hawaii, a general committee having been formed, representing all the commercial, industrial, social, educational, and scientific institutions, with the Governor as chairman. The committee gave definite assurance of adequate halls, excellent hotel accommodations, and hospitable entertainment. The winter meeting is to be held in Boston.

Following the Baltimore meeting a conference was held at the Cosmos Club at Washington regarding the present progress of geology in America. It was called by George Otis Smith, of the Geological Survey, and included representatives of the Federal, Canadian, and several State surveys, and of various museums and universities. It is understood that the discussions were quite informal, and very frank. It is expected that much closer co-operation will result. Another evidence of a change at Washington is seen in the estimates of the Geological Survey made public January 1, of the production of copper, spelter, and lead in 1908. There was never any good reason why the Survey, rather than private individuals, should not compile these returns, which, of course, come from the various smelters. It had, however, never been done before. Waldemar Lindgren and E. W. Parker are to be congratulated, and it is hoped that figures for other materials may next year be given. It develops now that the damage from the fire a few weeks ago in the Survey building is less than was estimated. Congress is to make good the loss. Whether it will at the same time appropriate money for the needed fire-proof building is less certain.

The geo-physists at the Carnegie Institution have taken up seriously the study of the simple sulphides. In view of the interesting results obtained from synthetical studies of the feldspars, and the great importance of the sulphides in ore deposition, mining engineers will doubtless welcome the news. Another piece of research, about to be undertaken, is a special study of calorimeters, which the Bureau of Standards is planning. This excellent institution is doing a large amount of good work which is too often overlooked. There are many problems relating to mining and metallurgy which it would doubtless be glad to study if the matter were properly brought to its attention.

LONDON.

Coal in Kent.—Messina Copper Mine. — Frecheville's Report. — Champion Reef.—Electrical Engineers.

Your readers probably hear vague news every now and then relating to the coal measures that are being exploited on the coast of Kent, close to Dover. There is a common supposition that the coal found here does not belong to the Carboniferous period, but that it is some more recent formation, such as lignite. The reason for this prevalent idea is that the workings are situated in a portion of England where the country consists of recent formations. In addition, not far away, ironstone and lignite used to be worked in the Wealden series from time immemorial. These ideas are quite erroneous, for the seams are portions of the true coal measures, and lie under the Cretaceous and other Secondary formations. They are found at considerable depth, and, judging from borings, they occupy a small basin perhaps 20 miles long and 5 miles broad. They have been traced under the English Channel, and it is probable that they are continuous with the coalfields in the north of France. It may be asked, why should these coal measures of problematical existence and at so great a depth through watery strata be so actively exploited. The answer is that the exploration was originally undertaken by Mr. Godwin Austen, a land-owner in Sussex, who was also a geologist. He was impressed with the theory that the French coal measures extended under the Channel and would be found in the southeast of England. His efforts were not crowned with success, for none of his borings ever passed below the Secondary strata. Some twenty years ago the subject was revived by Professor Boyd Dawkins, who encouraged Sir Edward Watkin, chairman of the South Eastern Railway, to utilize the abandoned Channel Tunnel works for the purpose. Sir Edward, seeing possible profit to his railway in the possession of a coalfield, supported the scheme and raised some capital. It is not necessary here to trace the

financial vicissitudes that overtook the venture after Sir Edward's death. Suffice it to say that two years ago an influential financial house pulled the scheme out of the mire, and the present board of directors includes a number of well known names in the coal world; for example, there are two of the directors of the Powell-Duffryn, which enjoys the reputation of being the most up-to-date colliery in Wales. At the present time the finances of the company are once more being put straight by the issue of new preference shares. The sinkings are on the seashore under the Shakespeare cliff, between Dover and Folkestone, and adjoining the line of the South Eastern railway between these two towns. There are two shafts, the first of which cut a coal seam at 1273 ft., and has passed through five others, the sixth being at a depth of 1614 ft. Bore-holes driven below this depth have intersected four other seams, the lowest being at 2221 ft. The other shaft is not down to the coal measures yet, and will be eventually used for hauling purposes. Driving has been done at the 1273-ft. level and some of the coal brought to the surface. It is a friable bituminous coal. The seams are mostly thin ones, being from 1 ft. to 2 ft. 9 in., with the exception of that at 2221 ft., which is 4 ft. thick. The intention of the company is to sink at once to this seam. Both of the shafts are circular, the first being 14 ft. diam., and the second 18 ft. They are tubbed with iron casing and concrete backing, the first shaft to 1600 ft., and the second as far as it has been sunk. Below 1600 ft. the first shaft is lined with brick and cement. Whether the venture will ultimately succeed or not remains to be seen. All that I can say is that the present board will make it a success if anybody can. A notice of this subject is not complete without reference to another company, which is also working on the coal problem near Dover, at Waldershare, Tilmanstone, and elsewhere,—but, as Kipling says, that is another story.

A year ago I wrote about the Champion Reef mine, at Kolar, India, and mentioned how this famous gold-producer had fallen off during the last year or two. Since then the exploration work has brought no bright ray of hope in the way of new discoveries of ore. For years the average content of the ore treated was well over an ounce per ton. Now they have fallen to 13 dwt. In addition, the amount of ore treated has been decreased and the ore reserves have been depleted. During the year ending in September, 172,006 tons of ore yielding 10.8 dwt. per ton and 231,101 tons of tailing yielding 2.5 dwt. per ton were treated, and the total production was 122,562 oz. bullion, which realized £466,172. Three years ago, when the mine was at the height of its glory, 215,167 tons of ore and 177,000 tons of tailing yielded 216,802 oz. bullion, realizing £825,263. It has not been possible to reduce the costs of operation to make up for the decreased value of the ore, so that the working profits have been greatly reduced. During the past year the profits were £143,938, out of which £52,000 was distributed as dividends and £65,000 written off capital expenditure incurred in sinking new shafts and erecting new plant. The dividend looks small, compared with the £416,000 distributed three years ago. The prospects of the Champion Reef mine do not look hopeful at present, but it need hardly be said that John Taylor & Sons, the managers, are not the people to be easily discouraged.

The Institution of Electrical Engineers has just acquired a handsome building on the Thames embankment for its permanent home. American visitors to London will probably remember the solid looking red brick building standing between the Savoy Hotel and Waterloo bridge. Its uses were never well known to the tourist or visitor, or for that matter to the Londoner himself. It belonged to the Colleges of Physicians and Surgeons conjointly, and was chiefly used as an examination hall. In future it will become better known to engineers. The Institution of Electrical Engineers has hitherto been content with a suite of offices on Victoria St., Westminster; these have become far too cramped for the growing body with its membership of over 6000, and it is now following the lead of the two older institutions, the Civil and Mechanical Engineers, in securing adequate accommodation in a building of its own. The Institution of Civil Engineers has been domiciled on Great George St. for many years, and not long ago re-built its premises in a handsome style. The members of the American Institute of Mining Engineers who visited this country two years ago will remember the building, as their joint meeting with that of the Iron & Steel Institute was held there. Unfortunately this building is to disappear before long, or to change hands, as the adjoining Government offices require the site for their own purposes. The Institution of Mechanical Engineers erected a building for themselves ten or more years ago, not far away, overlooking St. James Park. The Institution of Electrical Engineers was founded in 1870 as the Society of Telegraph Engineers, and William Siemens was the first president. Electricity was an unimportant affair in those days, and at the end of the first year the membership only numbered 110. By 1878 the numbers had grown to 1000. In 1881 the name of the Society was changed to the Society of Telegraph Engineers and Electricians, a change which was rendered necessary by the introduction of telephones, arc lights, and dynamos. Its present title was adopted in 1889. The list of presidents is a distinguished one, including as it does the names of Kelvin, Hopkinson, Swan, Crookes, Sylvanus Thompson. The Institution in its new home will continue to expand and flourish. One of these days, when the various English societies dealing with mining and metallurgy are amalgamated, as they should be, the mining interests of Great Britain will be represented by a strong institution with a handsome home of its own.

Some months ago, when writing of the development of copper deposits in South Africa, I mentioned the Messina mine in the northern Transvaal and promised to give some information about it at an early date. The present time is opportune for doing so, as R. J. Frecheville has just returned from making an examination. His views and opinions are of great interest. Briefly, he says that though the mine is extensive and the ore rich, it will prove unprofitable to work until there is better railway communication and a smelter on the spot. The Messina mine is situated 130 miles north of Pietersburg, which is at present the northern terminus of the Central South African railway. The company owning the mine, called the Messina Transvaal Development Co., of London, under the control of Chaplin, Milne, Grenfell & Co., is urging the Transvaal government to continue the line from Pietersburg to Messina, and thence forward another 100 miles to West Nicholson, where it would join the Rhodesia railway. For the last two years the ore has been hand-picked and mechanically concentrated, yielding 120 tons of concentrate per month averaging 60% copper. This is shipped to England. A year ago with copper at £100 per ton a profit was made, but nowadays, when it is down to £60, even this rich ore cannot stand the cost of transport. Mr. Frecheville recommends that operations be suspended until a railway is built, and that the company provide £100,000 properly to equip the mine and build a smelting and converting plant. The ore deposit is interesting and has been worked along the surface for quite five miles at various places by pre-historic metallurgists. The formation consists of gneiss and granite traversed by basic dikes. The ore is found in veins occupying fractures along a zone of shearing and crushing. The width of the mineralized belt is from 500 to 1000 ft. The lodes vary from 2 to 10 ft. in width. At the point where most development has been done, the old workings extend to 50 ft. below the surface. Further development by the present company has gone down to 300 ft. and has shown the existence of five defined lodes, nearly parallel, over a width of 600 ft. The orebodies are of irregular shape and consist of stringers, leaders, and bunches of chalcocite, bornite, and chalcopyrite in a gangue of crushed country rock with some quartz. From the beginning of operations up to the end of last September, 12,543 tons averaging 17.7% copper has been extracted from the mine, and from this 2541 tons averaging 60% copper has been sorted out and shipped. Some of the tailing has been stacked for future treatment, also some middling, and further supplies of low-

grade ore have also been placed on the dump. A concentrating plant to treat 50 tons per day was started in the summer, and during July, August, and September, this produced 344 tons of concentrate, averaging 59.5%, from 3441 tons of 10% ore. This is an extraction of only 60% of the copper content, but if it was not necessary to make so high a grade of concentrate, the extraction could be greatly increased. Mr. Frecheville estimates that the developed ore reserves are about 50,000 tons of 15% copper and he considers that there is every encouragement to expect further developments in depth and also laterally. He points out that the chalcocite and bornite are probably surface enrichments and will turn to chalcopyrite in depth, though there is no indication of this change so far as the workings have gone up to the present time. He is strongly of opinion that the rich ore should not be wasted in the present unprofitable manner, but should be conserved until such a time when it can be treated at a profit; therefore his recommendation to wait for railway communication, and in the meantime to develop the mine and erect smelting plant.

The Sulphide Corporation, which owns the Central mine at Broken Hill, with smelting works at Cockle Creek, is now getting better results, the new mill erected over a year ago being operated more efficiently. During the first six months of the present year, 100,943 tons were treated, yielding 18,591 tons of lead concentrate and 32,312 tons of zinc concentrate. The assay of the lead concentrate was 33⅓ oz. silver and 61.2% lead and the extraction was 45% and 70.5% respectively. During the second half of 1907 the extraction was only 42.5% and 66.8%. The duty of the plant has been still further increased, for during the 20 weeks from July to November, 1908, the extractions have been increased to 47.2% and 76%. The zinc concentrate produced during the first six months of the present year averaged 40.9% zinc, 12.5% lead, and 17.8 oz. silver and the extractions were 74.7% of the zinc and 72.3% of the silver. This is a considerable improvement over the previous half-year, when the extraction of zinc was 69.4% and the silver 61.8%. The extractions have been further improved, and during the 20 weeks specified the extractions have been 85% and 76.5% respectively. In addition to the above production, which all came from mine ore, 54,254 tons of zinc tailing from old dumps were treated during the first six months of 1908, and 19,545 tons of zinc concentrate was produced, averaging 14.4 oz. silver, 10.4% lead, and 44.2% zinc, the extractions being 79.6% of the zinc and 71.9% of the silver. Since then the extraction has risen to 82.3% of the zinc and 76.6% of the silver. The financial results for the year ending in June have been unfavorable, owing to the fall in the price of metals, and the net profit was only £8549. As there was a balance of £79,242 brought forward from the previous year, the directors have been able to pay £55,000 as 10% dividend on the preference shares. The ordinary shares get nothing. It is not quite clear how the company will be effected by the recent judgment against the Ballot-Sulman-Picard flotation process, which is used by this company for producing zinc concentrate.

BUTTE, MONTANA.

Copper Output in 1908. — Mine Ventilation. — The Snowstorm. — Raven.—Calumet-Corbin.

During the calendar year of 1908 the Butte mines produced 269,165,640 lb. copper, an increase of 20,278,124 lb. over 1907. The height of the financial panic and depression in the copper industry was reached in the latter end of 1907, and many of the Butte mines were closed and remained so until March 1, 1908, after which operations were gradually resumed. About June 1, when the industry in Montana was again demoralized by tremendous floods which did damage to railroads, mines, and smelters, and so crippled the smelter of the Boston & Montana Co. at Great Falls that it was not repaired and restored to full operation until about November 1. Prior to that date the Boston & Montana Co. mined a limited amount of ore and shipped to the Washoe smelter at Anaconda for treatment. The high mark of production was achieved in 1906 when the Butte mines produced 342,688,809 lb. of copper. The following table shows the total copper production in pounds of the various companies during 1908, compared with the production of 1907:

Companies.	1907.	1908.
Boston & Montana	63,053,655	77,010,800
Anaconda	64,154,636	67,064,000
Butte & Boston	9,209,650	10,349,640
Washoe	6,438,420	8,569,170
Parrot	5,403,010	6,281,080
Trenton	6,794,475	6,229,940
North Butte	29,534,240	38,526,480
Butte Coalition	24,971,800	21,488,580
Original	17,296,940	24,936,700
Pittsburg & Montana	4,785,090	4,295,100
East Butte	3,965,480	.....
La France	2,168,975	.....
Miscellaneous	3,111,145	4,414,150
Totals	240,887,516	269,165,640

The problem of mine ventilation in the Butte district has for years been a serious one, and although it has been agitated in the press and by the miners, the State has not yet adopted a law making the introduction of proper systems of ventilation compulsory. Whatever has been done in the way of improving conditions has been done through necessity in mining operations and not directly for the benefit of the miners. Some of the mines in Butte are insufferably hot, and only the lower grade of foreign labor can be induced to work in such places. The State mining inspector urges a law compelling companies to sink independent shafts for air, separate for each mine. Ventilation in the mines of the Amalgamated has been greatly improved by a system of drainage tunnels through which the water from the mines is drained to a central pumping station, avoiding the necessity of pumping plants in the different mines, and thereby reducing the temperature. At the Leonard mine a new development shaft is being sunk; as soon as connections were made at the 1500-ft. level with the other workings the temperature of the mine was reduced 20°. Similar results followed a connection with an air-shaft of the Pennsylvania mine at the 1200-ft. level. The question is again being discussed in the Montana legislature.

According to the annual report of the Butte Mining Stock Exchange, the only dividend-paying stock traded in on the exchange is that of the Snowstorm Mining Co. Not another stock is even within hoping distance of dividends. The Snowstorm has just declared another monthly dividend of 3c. per share. It is the fourth monthly dividend paid since the company resumed after a long suspension of operations during the financial depression. The company is shipping between 600 and 700 tons of ore per day, the cost of mining and delivery at the railroad not exceeding $1.40 per ton. Its return on shipments during December and January have been from 8 to 10% copper, with about 6 oz. silver per ton. A number of diamond-drill tests have been made, and the big insiders have been buying tock on the market, paying as high as $2.35 per share for it.

The Raven Mining Co., which is engaged in sinking a shaft, is cutting a station at the 1300-ft. point. The shaft is an incline, and the bottom has a vertical depth of 1100 ft. The lowest level is at 1100 ft., but a winze 100 ft. deep has been sunk from that level. The shaft will be sunk to 1600 ft. and another cross-cut driven to the veins.

The Calumet-Corbin Mining Co. has been incorporated under the laws of Michigan by Butte and Michigan men for the purpose of taking over and operating the old Minnesota mine in the Wickes-Corbin district. The company is capitalized for $1,500,000, divided into 150,000 shares of the par value of $10 per share. Twenty-five years ago the Minnesota produced considerable silver, lead, and gold. It is opened to a depth of 300 ft., where the ore shoot is 500 ft. long and from 2 to 5 ft. wide. The company has started to sink a two-compartment shaft.

JOPLIN, MISSOURI.

Production of Lead & Zinc in 1908. — Extensive Development. — Kansas Field.—Great Orebodies in Oklahoma.

The lead and zinc fields comprising the Joplin district, embracing a portion of three States, Missouri, Kansas, and Oklahoma, showed a small decrease in tonnage as compared with the year 1907, in both lead and zinc ores. The decrease in zinc ore was 27,000 tons, while the value of the zinc production for 1908 was $3,604,440 less than that of the production of 1907. The 1907 record for the output of lead ore was 2913 tons more than for 1908. The value of the ore for 1907 was $745,509 more than for 1908. The following table shows the tonnage and value of both ores in the three States for the year 1908:

State.	Pounds Zinc.	Value.	Pounds Lead.	Value.	Combined Value.
Missouri	439,889,384	$7,625,370	67,771,722	$1,862,380	$ 9,487,746
Kansas..	57,803,725	1,009,203	6,996,087	195,928	1,205,131
Oklah'ma	21,402,558	282,500	3,469,650	94,588	397,092
	519,095,667	$8,917,073	78,237,459	$2,152,896	$11,069,969

The average price of all grades of zinc ore for 1908 was $34.50 per ton, which was $9.28 less than the average price for 1907. The average price per ton for all grades of lead ore was $55.03, which fell below the 1907 record by $13.86.



Prospecting With a Drill Near Joplin.

From this it can be seen that zinc ore fell off 21%, while lead ore has fallen off 20%, from the prevailing prices of the previous year. During the same period the tonnage of zinc ore was decreased 9.4 and the tonnage of lead ore 6.7%. During the latter part of the year a heavy increase in production from the 'sheet-ore' mines was noticed because of the advance in the price of ore. These properties were idle during the period when zinc-ore sold below $38, but began activity as soon as the price reached $40. It was owing to this greater activity that the district was enabled to approach so closely the record for 1907. A number of mining centres increased their production for 1908, among which were Webb City, Carthage, Spring City, Sarcoxie, Carl Junction, and Zincite in Missouri, and Miami and Quapaw in Oklahoma. A notable feature of the increase in production was the greater tonnage of low-grade ore. The principal increase in Spring City and Sarcoxie was in silicate ore, while in the Oklahoma districts it was low-grade zinc-blende. In Miami the ores ran as low as 45% zinc, with an iron content of 6 to 12%. The increase in Carthage and Carl Junction was due to high-grade zinc-blende. Loss in tonnage was noticed in Alba, Joplin, and Duenweg in Missouri, and in Galena, Kansas.

Missouri led in the production of both lead and zinc during the past year. A large addition of new mineralized territory was opened during the year, especially in the eastern portion of the field. A large amount of prospecting and development has been done at Sarcoxie and Carthage, so that these two almost doubled their output during the year. The new territory extends the Sarcoxie belt eastward to Wentworth and westward to Carthage. Southwest of Sarcoxie during the latter part of 1907 a large amount of prospecting was done, demonstrating a great extent of ore-bearing territory. Development ceased with the panic, and it was not until the middle of the past year that active development was again begun. The most notable feature of interest at Carthage is the renewal of activity on the old Porter tract in the northwest portion of the city. Development has also extended across the river northwestward, where the largest production for this district was noted. These new properties are now well developed and will be ready for new mills during the early part of the year. This territory was formerly considered outside the mineralized zone. Many drills have been at work at Alba and Neck City and these have found ore in all directions. Some of the best lead and zinc deposits of the district have been found here. Five miles south of Joplin lies Spring City, which largely increased its production during the year, and extended its territory through extensive prospecting and development. The district has been especially fortunate in its large rich lead deposits recently opened. Five concentrating plants will be added here in the immediate future on properties which produce high-grade lead and zinc. At the present time the principal production is zinc silicate. New developments have also been made at Granby and Seneca, still farther south. These will add a large tonnage to the output from the district in 1909.

One of the most surprising increases during the year was the large production in the Webb-City-Carterville zone, which is the centre of the 'sheet-ore' area. Most of the large mills in this belt were idle during the greater part of the year because they could not produce at a profit at the prevailing prices. For this reason a decrease in production was expected, but during the latter part of the year, when ore passed the $40 level, a number of the larger plants resumed operations, and when the statistics for the year were compiled it was found that the district had surpassed the 1907 record by 2000 tons.

There was a decided decrease in production for the Kansas field during 1908, owing to the effect of the panic, but during this period a large amount of prospecting and development was done, extending the proved area in several directions. The principal addition to the Galena field was made by the Clermont Mining Co., south of the city, which has recently completed twenty drill-holes and has a number of shafts already well started on this virgin land. This company has added 500 acres to the productive mineral territory of Kansas. An important feature of the development has been the discovery of ore deposits at deep levels. North of the city an ore stratum was found lying between the 222 and 300-ft. levels. The ore-bearing rocks lie much deeper here than in the Joplin district. Extensive development is planned for the coming year in all these new fields. At Cave Springs an incline shaft is taking out ore at a deep level, the shaft being 440 ft. deep. The deep-ore levels have been demonstrated on about 120 acres north of Galena. In the Badger-Peacock district, lying north of Galena, the production fell off last year, but a considerable amount of development has been done extending the known mineral area. Two new plants have been added.

The new lead and zinc fields of Oklahoma have made the greatest strides of any in the past year. The extension

of the Miami field has been enormous. During the last three quarters of the year the production here was 6500 tons of zinc-ore and more than 1000 tons of lead ore. There are at present nine concentrating plants actively at work here, while at least four others are being built, or will soon have let contracts for construction. The excessive richness of the ore so far opened is the explanation for the large production from so few mills. This ore runs from 10 to 30%, greatly in excess of the 'sheet-ore' deposits in the Joplin and Webb City districts.

The greatest difficulty in the new field has been the concentration of the ores because of the oil and bitumen found in some strata of the deposits. The difficulty in concentration decreased the grade of the concentrate, making it from 45 to 52% zinc, with an iron content ranging from 6 to 12%. When this ore, impregnated with oil and bitumen, was treated in the jigs it had a tendency to float off the fine in the overflow and to carry over the concentrate mixed with the bitumen and gravel into the tailing. Thus the tailing piles became rich in ore running from 6 to 20%, or richer than the original ore at many of the older mines. Much advance has been made in the milling practice by the later mills, and some of these now produce a concentrate running as high as 56%, with an iron content of only 2%. The loss in tailing has also been decreased.

DAWSON, CANADA.

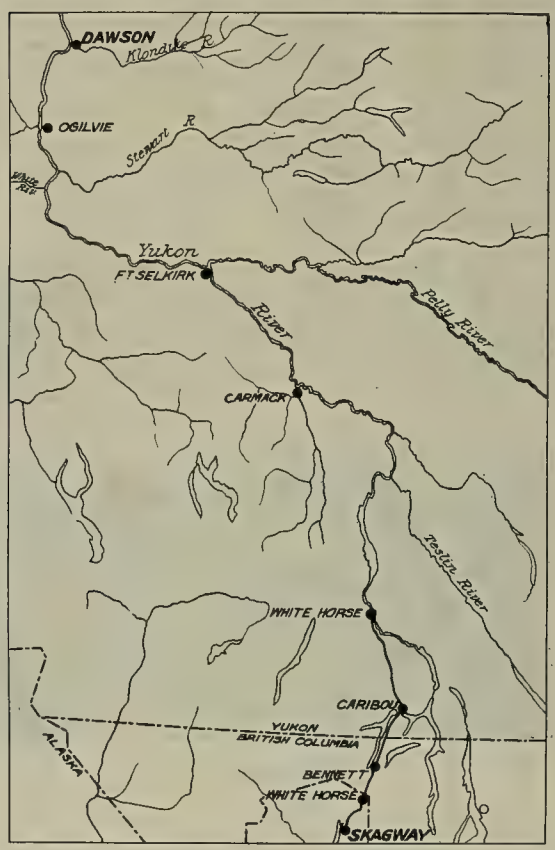
Mild Winter.—Dominion Creek.—Method of Working.—Lost Pillars.—Quartz and Sulphur Creeks.

Some of the mildest weather experienced in years has been the rule for the past month; this has had a tendency to retard winter work in some parts, but on the whole operations are well under way. In traveling along the creeks, one sees here and there dumps gradually assuming considerable size; these bid fair to be up to the average of former years when the spring clean-up takes place.

There is more work being done in the vicinity of Granville, on the lower end of Dominion creek, than anywhere else in the Klondike. The creek at this point is half a mile wide, and pay is found from rim to rim. The gravel is known as White Channel, and consists chiefly of well washed quartz; there is so little other material in the gravel that the tailing gives one the idea of being entirely quartz. The gold lies on a false bottom composed of variously colored clays; on this clay and for six inches to one foot above, the gold is found. This deposit has a value of 2½ to 3 cents per pan, and the gravel that must necessarily be removed is worth from $2.50 to $2.75 per cubic yard.

The method of operation in this locality is distinctive, a shaft of the usual dimensions—4 by 6 or 6 by 8—is sunk to a depth of 8 ft. in the clay bottom, thus forming a sump below the general level of the pay-gravel; this sump is filled with water, and is the source of supply for a pulsometer pump, placed slightly above the top of the water, which is kept warm by the steam necessary to run the pump. The water is delivered to the face of the drift, usually through canvas hose, where it is played against the frozen gravel, gradually thawing and caving the ground, in much the same way as similar work would be carried on above ground. When sufficient gravel has been caved and thawed, the pump is stopped, and men are put to work with pick and shovel; the gravel is then put into cars, run to the shaft, and there hoisted and piled in mounds at some convenient point on the surface to await the natural thawing of spring, when the gold will be extracted in the usual manner, namely, by sluicing. It is these mounds of dirt that we call 'dumps'. The method just described is found particularly effective, for the reason that no steam is necessary in the drift, such as would cause continuous sloughing of the roof and the handling of quantities of waste; it is also found that it is an easy matter to keep the roof properly arched where it is necessary, as is frequently the case, because the fineness of the gravel and lack of moisture make this deposit much more difficult to manage than the ordinary creek-gravels of this region. Practice has demonstrated that the gold extraction is clean, and the total cost of production is reduced to the lowest point yet attained in this district.

At the upper end of Dominion creek, considerable winter work is under way, but not on as large a scale as at Granville. Here are seen many small dumps, the work of one to three men, usually working with a hand-windlass. This kind of work is made necessary by the generally chopped-up condition of the creek. The claims have all been heavily worked in past seasons, so that the ground remaining that can be worked by the old method consists of pillars and bedrock that has been carelessly cleaned. These pillars are usually rich, being in the middle of the pay-channel; they were left behind by former workers after they had served their purpose, and were surrounded by waste. Strange as it may seem, it is a rare thing to find a claim-owner that has



Part of the Yukon Territory, Canada.

a positive knowledge of the position of such pillars; he only knows vaguely where they are, so that much money and time is frequently lost in finding such pieces of ground. A simple method of plotting each year's work when finished, would have been the means of saving money, time, and annoyance to most of the claim-owners of the camp. It would be well for those in the newer camps to adopt some such method, to avoid a repetition of this unsatisfactory state of affairs. Eldorado, Bonanza, and Hunker creeks are no exception to this failing, and the Yukon Gold Co. is going to reap the benefit; there is little doubt that these pillars will materially increase the value per cubic yard in all of the creek-bottoms that they control, beyond the estimate that they have placed upon them.

Quartz creek at the upper end is also a busy place; many dumps are well under way, and good results can be relied on, when the spring wash-up takes place. Sulphur creek is also hard at it, and some particularly good dirt is being hoisted on claims numbering in the forties Below Discovery. A fair amount of prospecting work is going on, at the lower end of this creek, with encouraging results. Reports are in circulation regarding districts that are farther away, but

it is too soon to form any opinion of their worth. Haggard creek is supposed to be doing well; this is a tributary of the McQuesten river and bids fair to become a producer of importance in the future. General business is good.

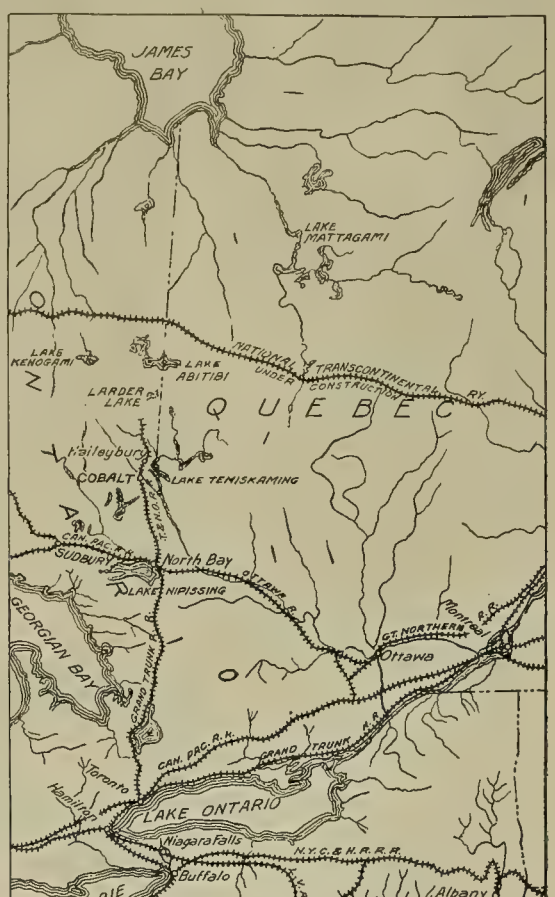
TORONTO, CANADA.

Farcical Enforcement of Anti-Wild-Cat Laws.—Gowganda Withdrawn from Prospecting. — New Road. — Dividends and Developments.

Apparently the stringent Ontario laws for the prevention of wild-catting by means of publicity are being enforced in much the same perfunctory fashion as the prohibitory laws in various States, where the fine occasionally or periodically levied on offenders after allowing them to run for a time with impunity, practically operates as a license to break the law. Provincial Secretary Hanna was loud in his promises to make an example of offenders, a number of companies were prosecuted, and the net result up to date is that four companies have been fined $200 each. These were the Crown Jewell, the Gifford, the Gifford Extension, and the Otisse. How easy the law-breakers have been let down can be understood when it is borne in mind that the penalty for false or defective prospectuses is a fine imposed upon each director of the defaulting company of between $50 and $400. The prosecution in these cases was instituted against all of the directors who could be reached, but after the infliction of one fine in each instance, the proceedings against the other directors were dropped. It is hard to see how, by any stretch of the imagination, the prospect of a $200 fine can be supposed to act as a deterrent upon a concern that is daily raking in thousands from credulous investors. It is petty as compared with the bulk of promotion expenses. The latest phase of the farce is the agreement between the Crown prosecutor and three of the companies, to submit a stated case to the magistrate, and should he then make a formal conviction, to carry the matter to a higher court. In the meantime, though wild-cat advertisements have largely disappeared, for which perhaps the holiday season and a break in the stock-market are responsible, the wild-cat promoters have taken to operating through the mails, and are sending out circulars, heedless of the warning that this is also against the law. Whether it is or not, or whether the law has any effective force, may be known in a year or two, when the higher court and the Court of Appeal have rendered decisions.

The Provincial Government of Ontario has issued an Order in Council withdrawing from prospecting a large area in the Gowganda district. This comprises, in addition to Haultain and Nicol townships, and two other unnamed townships, covering about 144 square miles, the bottoms of the lakes and a strip of land 66 ft. deep on the shores surrounding the lakes. This affects lakes Gowganda, Everett, Bloom, Miller, Le Roi, Wigman, and other bodies of water. A large area in the townships withdrawn has already been located by prospectors, and lakes Miller and Le Roi have also been covered, and some water claims made on Gowganda. All claims staked before December 18 are exempted. The purpose of the Government is to offer the properties for sale subject to royalties, as in the case of Cobalt lake. The most urgent matter before the Government in connection with northern Ontario mining interests is the opening of transportation facilities to Gowganda. The building of a wagon-road from Sudbury, 80 miles distant, has been undertaken by Mackenzie & Mann, of the Canadian Northern railway, on account of the Government, in conjunction with the town of Sudbury, that being the natural base of supplies for the district. Operations have already been commenced by a large force of workmen. The road is expected to be complete early in the New Year. Mackenzie & Mann have also in view the extension of the Canadian Northern Ontario railway into the Gowganda district from Burwash lake, and have put a survey party in the field.

There has lately been a seasonable dulness in Cobalt stocks, varied by a slight revival during the last few days as the result of satisfactory dividend declarations, and the influence of the New York market. A considerable advance on present prices is anticipated early in the new year. Nipissing has announced its regular quarterly dividend of 3% and an additional bonus of 2%. Some new finds of an encouraging character have recently been made on the property. A new vein was found in cross-cutting at the 75-ft. level from the Fourth of July shaft; the vein is 3 in. wide, yielding high-grade ore. At the 145-ft. level of the Kendall shaft, a new cross-vein was found, from 3 to 8 in. wide. The La Rose No. 3 vein, on which a shaft is being sunk, has widened to 4 in., yielding over 5000 oz. silver per ton. This vein has a length of 600 ft., and a portion of it has been developed by open-cut mining. A rich vein recently cut on the O'Brien runs into the La Rose parallel to the No. 3 vein, and will be worked by the latter company from No. 3 shaft. The new plant of the Temiskaming is on the ground, and partly erected. Two 100-hp. boilers are set up, and also the



Map Showing Position of Cobalt and New Districts in Ontario.

bed-plate of the new compressor, and it is expected that the plant will be in operation in two weeks, when considerable new ground will be opened. A new shaft has been started on the Duchess on the new vein near the Gifford Extension, and is now down 14 ft. The Kerr Lake Majestic will begin operations under the direction of William Powell, managing director, with an up-to-date plant, comprising a 12-drill air-compressor and boilers. The Cobalt Central is enlarging the capacity of its big concentrating mill, and will treat custom ore, having already made some contracts with adjacent mines. Shipments of silver to New York amounting to two tons were made this week from the Coniagas smelter at Thorold, Ontario.

The prize of $100 offered by J. B. Tyrrell, mining engineer of Toronto, for the best collection of Ontario minerals made during the past season, has been awarded to W. F. Battersby of the Kingston, Ontario, School of Mines.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

The import duty on lead ore is 1½ cents per pound, on pig lead it is 2⅛ cents per pound, and on white lead 2⅞ cents.

Graphite on the Pacific Coast would need to be of superior quality to find a market. Only crystalline graphite would be available; the amorphous variety not being in demand.

Assessment work is not required on a mining claim for the year within which the location was made. It makes no difference whether the location was made on January 1 or December 31; the law is clear on this point.

Molybdenum is present in the lead molybdate mineral wulfenite with many gold ores in the desert regions of the Southwest. It does not interfere with amalgamation. Molybdenite is a quite stable sulphide, not readily oxidizable, and is innocuous in gold milling.

Shaking plates for amalgamation are advantageous with certain ores, but they do not necessarily give better results than stationary plates. They effect an even distribution of the pulp, and by checking the flow they facilitate the settling of gold upon the amalgamating surface. It has been claimed that shaking plates keep brighter and require less frequent dressing, but except in individual cases this does not seem to be borne out in practice.

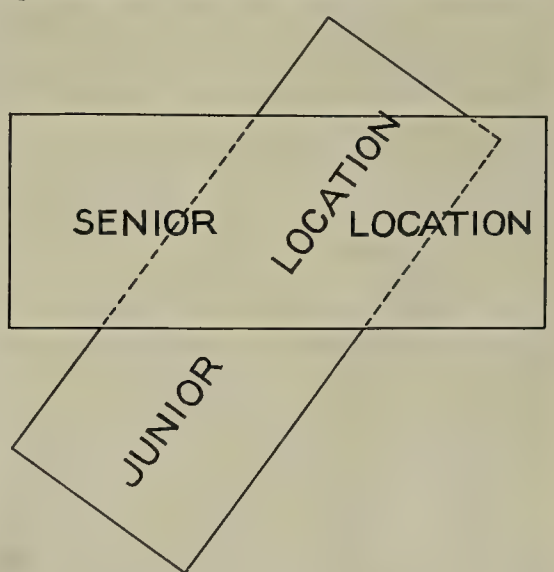
The statement that the Katanga ores contain a gangue "absolutely infusible at or near the melting point of copper" is misleading. All that is meant is that the gangue is deficient in base. The so-called 'reduction method', involving a treatment that will reduce the copper to the metallic state, after which it may be crushed and concentrated mechanically, is quite undeveloped in a practical way. Indeed it is wholly improbable that an economical separation can be effected by such a process.

Timber in a flooded mine, even after 20 years or more, will be found intact and temporarily unimpaired, but after exposure to the air it is speedily affected by decay. The condition of the mine-workings will depend upon many factors. In general the processes of decomposition of the ore and bounding country will be arrested by the flooding of a mine, but if much soft ore, or clay and sericite, such as the miner includes under the misnomer 'talc', be present, it will often be found that it has softened and flowed in large quantities into the drifts.

Failure to perform assessment work on a mining claim for any year except the year within which the location was made leaves the ground open for relocation. The courts hold, however, that unless the title has been extinguished by adverse location by some other person, the original locator's title may be re-established by resumption of work. The alternative of re-location is also open to the original locator, but if palpably done to avoid performing assessment work the title would be less secure against adverse claimants than it would have been by simple resumption of work.

Many metals and alloys used in the industries owe their valuable properties to the fact that they are in a state of unstable equilibrium at ordinary temperatures. Hardened steel, for example, tends to revert to the condition of soft steel at all temperatures below 700° F., and block tin is slowly converted into a gray powder, consisting of metallic tin, not a compound, at temperatures below 68° F. Polished cast-tin when inoculated with a little gray tin is rapidly changed and exhibits dull patches, which spread at the rate of several millimetres per day. The same rapid deterioration is shown by certain alloys of tin and aluminum, which also disintegrate into powder. These alloys break up after a few months, but the cause is probably to be ascribed in part at least to oxidation.

Where a junior location of a mining claim has been located across a senior location so that the junior claim is divided into two separate parts by the senior claim, it is now permissible for the junior claimant to maintain his title to the two non-contiguous segments by virtue of a single location, and he may obtain a patent for such a claim, though the patent would necessarily reserve all property rights pertaining to the senior claim. Prior to the Del Monte decision by the United States Supreme Court, the junior claimant was either compelled to elect which of the two disconnected parts he would take, or the entry was confined to that part containing his discovery. The Del Monte case decided that a junior locator might place his end-lines upon a senior claim, and the Land Department now permits a junior locator to lay his lines entirely across the senior claim, so as to include surface territory not covered by the senior location.



Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

National Bureau of Mines.

The Editor:

Sir—In the issue of December 5 I see an article on this subject. A perusal of it shows that the author of it has been connected with some kind of government bureau in the past, and appears quite content to remain in such a bureau for the present or the future. This being the case, we find, in general with those who have become part and parcel of a bureau, that he considers the correct solution of every problem in any way affecting the welfare of humanity to be the work of a Government bureau; and that the answers to all these momentous problems should be in the reports of such a bureau.

The nine problems that were cited are doubtless of a more or less pressing nature wherever mining or metallurgical operations are carried on; but a close analysis of many of those propounded is evidence to me that they are not from a trained engineer. Take, for example, the first problem: "A systematic investigation of underground methods of work carried on from camp to camp, with a view to a formulation of the exact conditions under which each method is applicable." Think of a Government bureau, constituted largely of a class to which in the West we apply the term "kid-glove miners," formulating plans for the successful operation of mines by *a priori* methods! These are problems that anyone familiar with the very rudiments of mining knows cannot be reduced to a formula. Mining is both a science and an art, and requires for its successful solution the application of both brains and experience.

The second problem has still less to recommend it as a basis for erecting a Government bureau and publishing long reports on this subject. The problems of hauling and hoisting have been exhaustively treated in three or four different languages, in books devoted to mining, and in many excellent periodicals. No tedious 'padded' Government reports from a Mining Bureau are necessary to enlighten those who are really interested in this phase of the question.

As to the third problem, what great benefit would gold and silver metallurgists be likely to derive from a study of the subject as set forth in a Government report? I would say: less than he would easily be able to gather from one of a number of first-class publications on the subject, or what is better: a careful digest of recent literature such as will be found in the *Transactions* of the American Institute of Mining Engineers, and the files of your own valued paper, and others that could be cited.

Thus we might go on; but the first three problems proposed, when examined, seem to be fundamentally wrong. Why? Simply this: the successful solution of every mining and metallurgical problem (or any other problem in engineering where man's intelligence must direct the forces of Nature to gain a desired end), involves the consideration of many factors, no two of which are likely to be the same in different places. If this were not so, engineering could not be called a profession, and the hundreds of young men who are today preparing themselves for work in engineering fields would have little to look forward to, if the proposed aims of the Mining Bureau should be faithfully carried out.

Whatever the specious pleas may be (and they are many and varied, as everyone knows) for the establishment of a Mining Bureau, we may rest assured that, if once established, few of the promises will be fulfilled. The great work of our mining and metallurgical world, the most important discoveries, the most useful applications of science, will continue to be made in the future, as in the past, by private and individual initiative, pluck, skill, and money. One Government bureau, more or less, will perhaps make little difference; the money necessary to support it will be drawn from so many that the increased burden is not felt; the valiant ones who have fought to establish it will be rewarded by positions of one kind or another, and the results, in many cases of doubtful value to the public, will possibly afford valuable exercise to those engaged in getting out the reports.

In my opinion, it is time the engineering profession as a whole, and especially the mining and metallurgical branch of it, should resent any further encroachments upon its legitimate domains by the enlargement of present Government bureaus and the establishment of new ones.

ROYAL P. JARVIS.

Knoxville, Tennessee, December 15.

Cost of Electric Pole-Line.

The Editor:

Sir—In answer to the request of your correspondent I am pleased to submit the following figures, showing the cost of constructing one mile of pole line in the Atlin, B. C., mining district, which was carried out by the Western Engineering & Construction Co., of San Francisco:

42 poles are required for 1 mile.	
42 poles, 8 in. at top and 26 ft. long, delivered on ground	$ 84.00
Cross-arms, 3 by 5 in., 48 in. long	21.00
Insulators and pins, 126 each	94.50
3 lines No. 6 wire, 1152 lb., at 15c	172.80
Engineering expenses	26.00
Post holes; all tools furnished by the company; average over a 10 mile line, including powder and drills for blasting many holes; holes 5 ft. deep	63.00
Peeling poles and fitting cross-arms	31.50
Setting up poles and tamping	42.00
Stringing wire	42.00
Paraffine for dipping pins and cross-arms	7.14
Distributing cross-arms, insulators, and wire	10.50
Clearing right-of-way and road	52.50
	$646.94

The line was transposed three times in the eight

miles, for which 36-ft. poles were used. We employed a gang of five men, a water boy, and foreman. The men were paid $5 per day for 10 hours, water boy $3, and foreman $7.50. Cutting and delivery of poles and distribution of material was by contract. The men rendered good service, probably 25% better than could usually be had under similar conditions. The engineering expenses were higher than any other part of the work, but under the conditions this could not be avoided. Freight and other small expenses ran the cost up very close to $750 per mile net, and $1000 is the least any company should figure on, as poles are more liable to cost $5 each than $2, which was the price paid in this case. Local conditions must always be taken into consideration as to cost of construction. Freight to all northern inland points will be about $75 per ton on this class of material.

D. P. CAMERON.

San Francisco, December 28.

Drill-Steel.

The Editor:

Sir—I have received several letters asking for further particulars about the 'Spiral Drill Steel' suggested by myself in the MINING AND SCIENTIFIC PRESS of December 5. The exact amount of twist that the steel will stand must be determined by test. It is my opinion that a quarter turn to an 8-ft. drill will be sufficient to keep the hole clear of cuttings in all except the softest of rocks, where more turn would perhaps be desirable. The twist, or turn, is so magnified in the backward stroke of the piston by its rotation that each rib will offer a continuous lug for the full length of the drill-stock. Then too, when the drill is running in a 'free' hole, that is, not binding in the hole, the piston does not entirely stop rotating at the end of the backward stroke, but is still turning as it starts on its forward stroke; thus the twist of the steel is likely to become a minus quantity. I am informed by R. A. Kinzie that a test of the steel is to be made at the Treadwell mine as soon as circumstances will permit, and no doubt a report of the test will appear in this paper in due time. As to the effect this twist will have on the strength of the steel, I would be pleased to hear from others. This is a vital point, and the only one on which I have any doubts.

K. NOBLETT.

Treadwell, Alaska, December 20.

The Disaster in Italy.

The Editor:

Sir—Though offering no scientific explanation of the cause of the late catastrophe, I would suggest that an editorial on the effect of it upon world politics, would be welcome. We have had the dread of war for several years, which would ultimately involve the entire civilized part of the inhabitated areas. First came the earthquake in this, our home town, and we felt immediately the throb of sympathy from humanity. Then followed Valparaiso, and Kingston to knit more closely the bonds between the various types of reasoning animals, all of whom carried red blood in their veins. Lately the rumors of war and the changes in the map of the inhabited portions of the globe have become more virulent (if I may use the term), and now how does the world feel? Every nation is vying with the other in rendering aid to our stricken brothers; Russian and Japanese, German and French, American and Spanish are extending the hand of charity to our fellows, now suffering the worst that Dante ever pictured in his native land of Italy. It is a thought that has come to me, a pupil in scientific knowledge, that no matter how we may explain the material phenomena, the final result will be to increase the mutual respect of all nations for each other, reduce the friction that produces war, and makes us all akin, one nation, one people. To give and to take without the agency of the cannon and the battleship, and be able after a wordy discourse (from which each derives benefit) to shake hands, and generally to understand and believe the old adage that a soft answer turneth away wrath, as well as that there are always two sides to a question.

Such a disaster as has just occurred will do more to knit all of us together than any war with its subsequent resentment, any peace-meeting at the Hague, where each nation still tries to dominate, or any triumph of science in overcoming the forces of nature. I trust we can read something of moment from your pen should you consider the above suggestion of any value to the public, leaving the scientific discussion to the time when we have facts.

W. J. ADAMS.

San Francisco, January 2.

Ely, Nevada.

The Editor:

Sir—In your issue of January 2, in an article written by Courtenay De Kalb on 'Copper Mining at Ely, Nevada,' it is stated that "The name of Ely was not transferred from Ely, Vermont, to Nevada." I wish to make a correction in the history of the now famous copper city and in memory of Smith Ely. I can do so with assurance, as the place was named by myself. Thomas H. Selby, nephew of the founder of the Selby smelting works, and myself were partners, by purchase or location, in nearly all the copper claims in the Robinson district, Nevada, more than 30 years ago. We disposed of a half interest for $35,000 to Smith Ely, of Ely, Vermont, through his copper expert, Joseph Long. We purchased a ranch on Murray creek, containing some 320 acres; patent issued to George Lamb, but was claimed by a Mr. Cummins, to whom the judges of White Pine and Eureka counties, with a third arbitrator, assigned the title on the ground of fraud. This ranch covered the site of Ely, where the first copper smelter was erected. As we needed a postoffice at once it was necessary to name the place. Mr. Selby, Joseph Long, Lewis Williams, afterward for 20 years metallurgist at the Copper Queen in Arizona, and myself held a consultation in our cabin over a name for the new place and postoffice. None of us cared to be immortalized in this connection, and so I suggested the name of Ely, as a compliment to Smith Ely. We all thought it was just the proper name and that it would please Mr. Ely, as it did. I obtained the first postoffice, with

the privilege of a daily mail. For many years I lived near Steptoe valley, having been connected with various mines in the vicinity. I was well acquainted with the Mr. Ely of whom Mr. De Kalb speaks. He had nothing to do with the naming of Ely in White Pine county, but his name survives in the Raymond & Ely mine and the Ely district some hundred miles or more distant, in the neighborhood of Pioche, Lincoln county. Williams and Long are dead. Thomas H. Selby is living in Mexico, and can corroborate what I have said.

F. F. THOMAS.

Berkeley, January 4.

The Editor:

Sir—I am glad to have the correction communicated by Mr. Thomas. It is in a certain sense significant of the creative energy, still a dominant characteristic of the West, that it is so absorbed in the work of developing natural resources as to lightly treasure its historic records. Earnest efforts were made to ascertain the very facts which Mr. Thomas now supplies, and as a result of correspondence with those long identified with the district the discordant opinions collected at Ely were reduced to what seemed to be the truth. It is interesting to note that a link does exist between the little Vermont mine and the great property in Nevada that promises to be famous as a gigantic producer of copper for generations.

COURTENAY DE KALB.

San Francisco, January 6.

Loss of Cyanide.

The Editor:

Sir—In your issue of November 7, Rivers R. Baildon asks for "some information regarding the mechanical loss of cyanide incurred in operating such slime-filters as the Moore, Butters, Kelley, or Burt." The loss due to chemical decomposition is difficult to determine; but cyanide consumption is due to chemical loss and to mechanical loss. Each ore treated by cyanidation causes an unavoidable chemical loss of cyanide, which is constant for any given set of conditions. The factors determining the chemical loss vary with the character of the ore, the loss increases with fine grinding, increases with strength of solution used, depends upon the degree of alkalinity of solutions, and upon the amount of solutions used per ton of ore.

Mechanical losses are due to leakages, and to loss of cyanide in the discharged residue. The following is an account of losses in the North Star mill, at Kofa, Arizona: The ore is a hard, compact, silicious rock, carrying much free gold. Losses from leakage are slight. Losses in residues from the Kelley filter-press vary from 0.04 to 0.7 lb. per ton of residue discharged, the amount being directly proportional to the cyanide strength of the wash solution, and to a lesser degree to the length of time of wash, and rate of wash. The ore, after coming from dry-crushing rolls and passing through a No. 16 mesh screen, is fed to an Abbé silex-lined tube-mill, and ground to slime, in a cyanide solution containing about 4 lb. potassium cyanide and from 2 to 4 lb. lime per ton. The ground slime receives an air-agitation in cone-bottomed vats, after which it goes to the Kelley press.

An actual example of the working of the press and of the mechanical losses follows, the filter-press charge consisting of 1066 lb.:

	Minutes.
Time filling press with pulp, sp. gr. 1.27	4
Time loading frames	12
Discharging pulp and re-filling with solution	5
Solution wash	10
Discharging solution-wash and re-filling with water-wash	4
Water-wash	10
Discharging water-wash	2
Discharging cakes and returning frames	21
Total time of cycle	1 hr. 8

The cake formed contained 28.4% moisture, was 1¼ in. thick, and there were 410 sq. ft. of filtering area. The cyanide in the original pulp was 4.7 lb. per ton of solution, and the cyanide in the wash-solution was 3.8 lb. per ton.

The water-wash began at 0.4 lb. KCy per ton and ended at 0.2 lb. per ton, due to the addition of fresh water during washing. The actual mechanical loss in this case was 0.0568 lb. KCy per ton of dry slime. No cyanide-solution is intentionally run to waste in this plant. For this reason, the wash-water is sometimes dispensed with to prevent an accumulation of mill-solutions. Had a 20-min. solution-wash been given, instead of the solution-wash followed by the water-wash, the mechanical loss of cyanide would have been 1.07 lb. per ton of dry slime. The actual total cyanide consumption over a period of three months, calculated from tonnage of ore treated and the potassium cyanide used, was 2.23 lb. per ton of dry slime.

The cyanide loss, per ton of dry slime, at the Butters Devisadero mines, in Salvador, Central America, in the summer of 1906, was 3.38 lb. KCy per ton of dry slime. This plant was then all-sliming. The ore was slimed in cyanide solution in a tube-mill having a cast-iron lining; the fine iron worn from the lining was accountable for the high cyanide consumption. A test made when the pulp carried 0.12% KCy per ton of solution, with wash-solution at 0.058% and wash-water free from cyanide gave at the end of a 45-min. solution-wash 0.069% KCy in the discharged solution, and at the end of a 30-min. water-wash 0.039% KCy in the discharged solution. The moisture in a cake from the Butters filter runs from 28 to 40%. The mechanical loss of cyanide is from 0.21 to 0.55 lb. KCy per ton of dry pulp.* Cyanide solution was never intentionally run to waste.

DANA G. PUTNAM.

Kofa, Arizona, December 18.

The gold output of Rhodesia for September, of this year, was 48,573 oz., of which 26,540 came from Matabeleland, and 22,033 from Mashonaland. Since the commencement of mining operations in that colony the gold production has amounted to 3,061,582 oz., having a value of £11,211,920.

*"The Filtration of Slime by the Butters Method.' E. M. Hamilton, MINING AND SCIENTIFIC PRESS, June 29, 1907.

METAL PRODUCTION IN 1908.

The United States Geological Survey issues the following statistical review:

Copper.—To the copper industry of the United States the year 1908 was a period of gradual recovery from the severe depression suffered in the last part of 1907. Many producers that had greatly curtailed or even suspended production in that year began again to increase their output at the opening of 1908, and in spite of the low price of the metal, nearly all the important producers were in operation throughout most of 1908, and a few new companies began production during the year. The rate of production has been steadily increasing, and is now greater than at any other time in the history of the industry. The production of copper in 1908 has been ascertained by L. C. Graton, of the Geological Survey, through personal interviews and telegraphic communication during the last days of the year. Except one small company, all producers of blister and Lake copper have furnished their latest exact figures, in most cases for eleven months, together with estimates of their production for the remainder of the year. If these estimates are realized, the production of blister and Lake copper in 1908 from ores mined in the United States will be greater by about 50,000,000 lb., or between 5 and 6%, than that in 1907, which was 868,996,491 lb. It is impossible at this time to publish figures of State production, but it may be said concerning the three great copper producing States, that Arizona and Montana show large gains, while Michigan shows little change from 1907. Production of total refined new copper by works in this country hardly equals the output of 1907, which was 1,032,516,247 lb. Based on records of the Bureau of Statistics covering the first 11 months, the 1908 imports of copper in pigs, bars, etc., are estimated at about 160,000,000 lb., and in ore and matte at about 53,000,000 lb. With addition for copper in pyrite, not included above, the total imports may be estimated as equivalent to about 210,000,000 lb. refined copper, a decrease of about 13% from 238,031,320 lb. in 1907. On a similar basis, the exports of metallic copper are estimated at about 660,000,000 lb., the largest ever recorded, and an increase of about 30% over the 508,929,401 lb. exported in 1907. Stocks of refined copper are still undoubtedly large. Domestic consumption of new copper will show a decline from the 485,000,000 lb. of 1907. The average quoted price of electrolytic copper at New York for 1908 was 13.20 cents. The price at the close of the year was 14.18. The prospect is bright at the present for a still larger copper production in the year 1909.

Spelter.—The production of primary spelter from domestic and foreign ores in 1908 is estimated at 208,000 short tons, worth at the average price $19,656,000, as compared to 249,860 tons in 1907, 224,770 tons in 1906, and 203,849 tons in 1905. Imports of zinc ore comprised 26,000 tons of duty-free calamine (silicate ore), valued at $22,000, and 34,000 tons of dutiable ore (carbonate and sulphide), valued at $383,000. These imports, which were practically all from Mexico, show a decrease of nearly 50% over the quantities of the corresponding ores imported in 1907, which were 81,973 tons, and 28,867 tons respectively. The exports of zinc ore also show an increase, being 26,108 tons, worth $877,745, compared to 20,352 tons in 1907. The imports of spelter show a decrease of 50%, being 894 tons worth $85,000, compared to 1778 tons in 1907. The exports of spelter show a marked increase, being 2500 tons, valued at $238,000, as against 563 tons in 1907. The exports of zinc dross were 8683 tons, in value $483,000, compared to 9593 tons in 1907. Prices maintained a uniform but very gradual ascent throughout the year. The average New York price of prime Western spelter for the year was 4.73 cents per pound, the extreme fluctuation in value ranging from 4.32 to 5.15. The production of spelter from domestic and foreign ores, apportioned according to States in which smelted, was approximately as follows: Illinois, 49,500 tons in 1908, as compared to 56,056 tons in 1907; Kansas, 98,000 tons in 1908 and 134,108 in 1907; Missouri, 10,000 tons in 1908 with 11,732 in 1907; Oklahoma, 15,000 tons in 1908 against 5035 tons in 1907; Western, Eastern, and Southern States, 35,500 tons in 1908 and 42,929 tons in 1907. These figures of production, prepared by C. E. Siebenthal, of the Geological Survey, are based on reports received from all operating zinc smelters.

Lead.—The total production of primary refined lead, desilverized and soft, from domestic and foreign ores in 1908 was approximately 391,000 short tons, worth at the average price $32,844,000, as compared to a production of 414,189 tons in 1907 and 404,699 tons in 1906. These figures are exclusive of an estimated output of 12,000 tons of antimonial lead, as against 9910 tons in 1907. Of the total production, desilverized lead comprised 287,500 tons, as against 314,241 tons in 1907. The soft lead production increased to 103,500 tons, compared to 99,948 tons in 1907. The increased output of soft lead accompanying a decrease in desilverized lead means apparently that Missouri retains the first place among lead-producing States. There was 50% increase in the imports of lead in ore and base bullion, which amounted to 105,000 tons, valued at $4,160,000, as compared to 70,538 tons in 1907. From this it may be inferred that the production of desilverized lead of foreign origin increased considerably over that of 1907, which was 67,423 tons. The imports of refined lead fell off considerably, being 3000 tons, with a value of $200,000, against 9277 tons in 1907. The exports of foreign lead (lead of foreign origin smelted or refined in the United States) show a similar increase of nearly 50%, being 75,000 tons, valued at $3,024,000, compared to 51,424 tons in 1907. The exports of lead manufactures remained practically stationary, with a value of about $600,000. The price of lead started in January with a minimum of 3.625 cents per pound, rising to the maximum figure of 4.60c. in August, then declining slowly to the close of the year. The average New York price for the year was 4.2. These figures of production were prepared by C. E. Siebenthal, of the Geological Survey, from reports and estimates by the desilverizers and the soft-lead smelters.

THE YUKON DITCH.

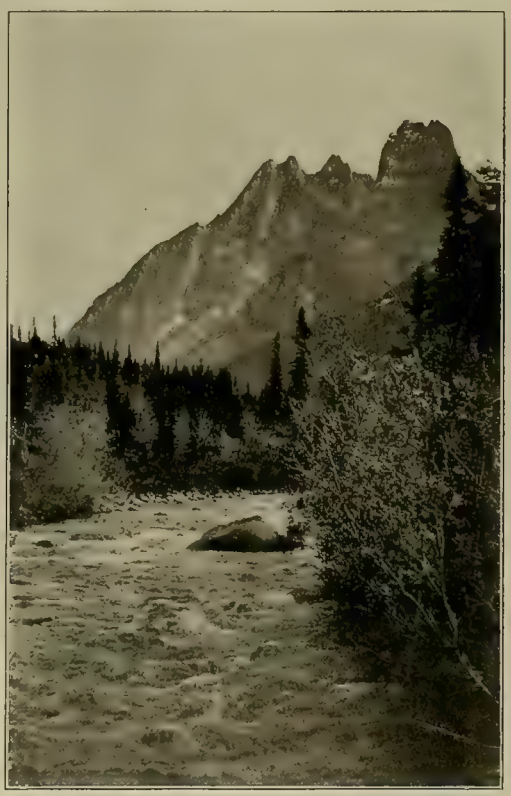
Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

In order to facilitate the exploitation of gravel deposits situated on the Klondike river and its tributary creeks, the engineers of the Yukon Gold Co. have built a system of ditch, pipe, and flume that has a total length of a little more than 70 miles. In July, 1908, it was my good fortune to observe the building of this conduit and to note some of the details of an engineering project as important as it is costly.

The country traversed by this ditch is a rolling woodland indented by the alluvial flats of the Klondike, the Twelve-Mile, and other streams flowing into the Yukon river. As seen from a height the wilderness stretches unbroken from the meandering shimmer of the Klondike, enclosed within high banks on which white scars mark bench-diggings, to the Ogilvie range, where, far to the north, the snow still lingers in token of the gift of water that shall enable man to win the gold from the deposits of gravel strewing the tortuous valleys. The engineer who first planned the line of flume, ditch, and pipe had imagination—that kind of constructive imagination which is the creative force behind all engineering work. He imagined the deed done, and then he calmly began to calculate how to accomplish it. As viewed from afar the panorama of wooded valleys, and the distant range that serves as a watershed, afford no suggestion of the natural obstacles to be overcome, but a closer acquaintance soon demonstrates that the forest is but a scant growth of small trees, just fit for telephone poles, not big enough to yield lumber, struggling to assert a stunted life amid the vast morass covering the face of the land. A soggy blanket of moss mantles the ground, which is held in the grasp of a perpetual frost. Under the moss is ice; the moss forms an insulating blanket so that even the short warm summer does not thaw the frozen ground lying beneath this dark green coverlet. In places the ice melts slightly and pools of water form. Everywhere the surface is wet and sloppy. Our horses splashed through it. We stumbled over the spongy mass. It is a dismal swamp, which becomes almost impassable when torn by traffic. Wherever a trail was worn by use, it became a quagmire and it was best to turn our horses to the untrodden moss alongside; in this their feet would sink to a depth of 6 or 8 inches, for below that was the frozen ground; while in places, where the moss was cut and worn away, the thaw had reached deep enough to make progress impossible. And these conditions obtained not only on the flats, but on the slopes. The water is held by the moss as by a sponge, so that even over an undulating topography there were no running streams.

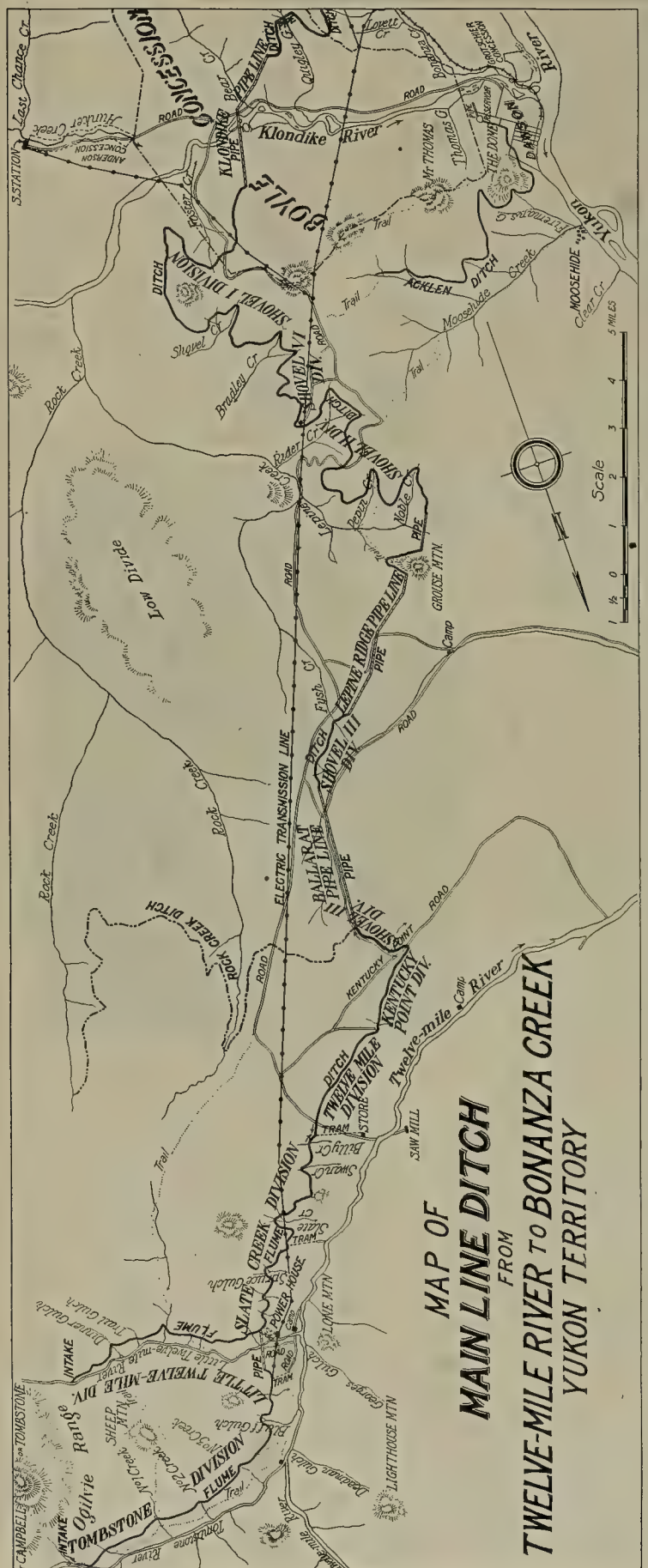
Roads of the corduroy type have been constructed, moss being laid on the poles and dirt on the moss. The trails traverse the brush in straight lines. Horses and men, steam and muscle, have fought against the wilderness and subdued it. The big ditch looks like a Panama canal and the steam-shovels groaning and digging in the deep cuts recall pictures of Culebra. Many of the laborers had worked on the isthmian canal, and assuredly the young engineers were as proud of the work they were accomplishing as if it were a national or even an international enterprise. The wilderness that had laid in shivering silence for untold ages, responsive only to the footfall of the moose and the cariboo, hearing only the voice of the stream and crash of the tempest, has been invaded to the very threshold of the Arctic by insistant man, determined to use Nature to his purpose, to overcome her obstacles by turning her own energy and her own power to his good in the quest for gold.

Several schemes for bringing water under pressure



The Tombstone River at the Intake.

to the placer mines on Bonanza and Hunker creeks have been considered during the last five years. One of these involved the use of the water flowing in the Klondike river, but it was ascertained by survey that the low gradient of that stream would necessitate a ditch fully 85 miles long and an expenditure of about $7,000,000. A. N. C. Treadgold, the promoter of the enterprise now known as the Yukon Gold Co., made surveys along the tributary streams flowing into the Klondike and the Yukon from the north. Finally he applied for a right of way for a ditch to tap the head of the Twelve-Mile river. This enters the Yukon 18 miles below Dawson, and has its source in the Tombstone range, a part of the Ogilvie mountains, which rise to an altitude of 7000 ft., and gather sufficient snow to furnish a constant supply of water. It was estimated that a ditch to the mines near Dawson, with a capacity of 125 cubic feet per second, under a head ranging from 850 to 350 ft., would be 70 miles



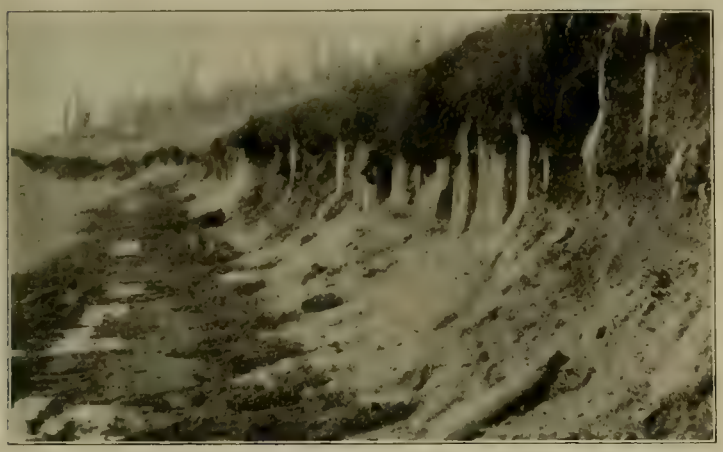
long and would cost $3,000,000. It has cost over this amount to date and will require a further expenditure to complete. The total distance between the head of the ditch and Gold hill, the point of distribution, is 70.2 miles, the difference in elevation between these points being 1112.8 ft. The effective head along Bonanza creek, in the vicinity of Gold hill, is 375 ft. The construction includes 19.6 miles of flume, 38 miles of ditch, and 12.6 miles of pipe. Owing to the nature of the ground traversed, it has been necessary to modify the size and gradient of the ditch according to local conditions, but the standard is a 9-ft. bottom, with 3½-ft. depth of water, and a gradient of 6 ft. per mile, ranging from a minimum of 4 ft. to a maximum of 7 ft. per mile. In places the ditch is fully 20 ft. wide. The standard flume is 6 ft. wide and 4 ft. deep, with a gradient of 0.2841% or 14 ft. per mile. The pipe varies according to the engineering requirements and is variously built of steel and wooden staves, so as to have a diameter ranging from 42 to 54 inches. The accompanying map shows the course of the water system and the distribution of the various forms of construction.

Wherever practicable the water is conducted by ditch, for that is the cheapest and most durable conduit. A ditch is necessarily dependent upon the contour of the surface; where depressions exist, a long detour is saved by building either a flume or pipe. If the depression is a deep ravine or a broad valley, it becomes impossible to construct a flume, and recourse is had to a pipe in U-form (forming a so-called inverted siphon), the loss of effective head being measured by the friction between the water and the sides of the pipe.

In constructing the flume, the sills of the bents are laid in good ground, that is, below the surface dirt, upon solid rock or else upon débris that will not shift after thawing. In laying pipe along a declivity, the weight at the depression is taken by bents carried through the surface dirt to the gravel underneath.

The completion of this ditch in

three seasons, equivalent to one full year of 12 months, is a feat highly creditable to the engineers.



Where Shovel No. 3 Encountered 'Frost'.

Owing to the large amount of money paid for mining claims, and to the heavy investment of capital involved in the building of the ditch, it was imperative that the water be brought to profitable use as speedily as possible. The first thing was to obtain power for the dredges. A sawmill was built on the right bank of the main Twelve-Mile on a site commanding the best supply of logs. This sawmill was operated by steam-power. Then a flume 5½ miles long, 3 by 4 ft., was built on the stream known as the Little Twelve-Mile, and an electric power-plant was erected near the place where the main water-system would cross the valley and two miles above the sawmill. Meanwhile the survey for a transmission line was hastened. This was in June, 1906, and it is interesting to relate that in making the survey for the pole-line the engineers worked both by day and night, the two shifts being in friendly competition; nor did the night crew complain of any handicap through poorer light. At that season the night is only two hours long, for Dawson is at latitude 64° north.



Construction of Cribbing.



Cribbed Ditch.

Electric transmission is effected over 36 miles of main line and 18 miles of branch high-tension line, with 8 miles of secondary lines from 4 sub-stations. The power-plant receives 60 cu. ft. of water per second under an effective head of 650 ft., the delivery from the flume being effected by a steel pipe gradating from 36 to 34 and then to 32 in. diameter. Two Pelton wheels, actuated by a 4-in. and a 3-in. nozzle, respectively, are harnessed to two Westinghouse generators of 625 kw. each. By a three-phase system 2200 volts are stepped up to 33,000 volts, at which tension the current is transmitted over a No. 5 copper wire. A deflecting-nozzle governor is an interesting feature of the Pelton wheels.

While preparations were thus being made for the transmission of power, the work on the ditch was begun. As soon as the surveys were completed, the right-of-way was cleared. The small growth of forest was removed, and the moss stripped from the frozen ground for a width of one chain (22 yards). Then steam-shovels were put to work, and while they were digging the ditch, the sawmill on the Twelve-Mile yielded the lumber needed for the construction of the flume and for other purposes. Seven million feet (board measure) of lumber was cut; this depleted the small forest available, but it proved sufficient. Electric power was employed in pulling the lumber up a tramway built from the sawmill to the site of

the flume, this form of construction being confined largely to the first part of the conduit.

Without the steam-shovel it would have been hardly possible to dig the ditch in an economical manner, for manual labor at $4 per day, plus board at $2, or a total of $6 per day, is a costly instrument of engineering. Six shovels were employed. These make the cut, which is then beveled by hand, to be followed by the laying of moss on the sloping sides, with a little fine dirt as a finishing touch.

On July 19 I saw the No. 1 Shovel at work on the Klondike Face. This shovel had then dug 8 miles of ditch. The machine was the Little Giant Shovel, made by the Vulcan Iron Works, of Toledo, Ohio. It weighs 36 tons and uses 45 hp. A 4-ft. extension on both the boom and dipper-handle affords 18 ft. of clearance from the centre of the track. The dipper is re-inforced for this special work, and excavates 1¼ cubic yards at each swing. The machine is mounted on railroad trucks that run on a track of standard gauge. After 5 minutes of digging, the shovel is advanced, the move being accomplished in 5 to 10 minutes. The shovel was digging in soft silt requiring special treatment. Boughs of spruce were laid criss-cross upon the bottom of the cut so as to form a mattress, upon which the ties were laid, and on them the rails. The shovel dug an average of 300 ft. of ditch (9 ft. wide at the bottom) in 24 hours and had made as much as 365 ft. in a shift, the average being 1200 cu. yd. per day, and the maximum 1600 yd. per shift of 10 hours. The fuel used in the boiler was small birch that had been dried in a forest fire.

On July 21 I saw No. 3 Shovel at work on the Ballarat Division. This machine is a Model No. 20, made by the Marion Steam Shovel Co., of Marion, Ohio; it was making from 35 to 40 ft. in two shifts, but it had made a record of 680 ft. in one shift. The crew included three men on the shovel, namely, the fireman, craneman, and engineer. In the cut there were 6 men and a boss, all of whom joined forces when the time came to move forward. Two men attend to the lifting-jacks and one to the blocks in the rear. The total cost of labor was $175 to $200 for the two shifts, this including a roustabout, who gathered wood, and the hauling of water for the boiler. The shovel was doing nicely in ground well adapted to a tight ditch. Progress averaged 200 ft. of ditch per shift, each foot of advance being equal, approximately, to 3½ cubic yards. On the low side of the ditch the cut was 5 ft. deep.

Shovel No. 5 was working on the Twelve-Mile Face. This machine was made by the Thew Automatic Shovel Co., of Lorain, Ohio. The State of Ohio is rich in the manufacturers of good machinery. The Thew shovel weighs 35 tons, it has a dipper of 1½ cu. yd. capacity, and a clearance of 23 ft. Owing to the ample swing, the shovel was digging a ditch 20 ft. wide at the bottom. The boom is made fast to the car-body, carrying the engine and boiler, so that the whole machine acts as a unit. It is swung on a four-wheel truck having an 8-ft. wheel-base. The shovel is not suited to soft ground, but does excellent work when digging a shallow wide ditch in moderately hard ground. The machine had made 75 ft. of advance during the forenoon of my visit and was averaging 200 ft. per day of 24 hours.

As the map shows, the aqueduct is separated into divisions each having a name by which it is known to the engineers. A record of progress made on each division is kept by plotting the weekly advance in percentage of the total construction.

Details of construction along successive portions of the undertaking are given herewith, as gathered on the spot, by courtesy of Messrs. O. B. Perry and Chester A. Thomas, the managers.

Tombstone Creek.

41,000 ft. of 4 by 6 ft. flume.
Main intake at 3317.8 ft.

Little Twelve-Mile.

Intake of pipe	at 3199 ft.
Discharge into flume	at 3104 ft.
Lowest point	at 2459 ft.

Details of Pipe.

Length, Ft.	Material.	Diam., In.
399	Wood	49
3,540	Steel	46
429	Wood	49

Slate Creek.

32,000 ft. of 4 by 6 ft. flume.
Less 800 ft. of ditch.
Grade, 14 ft. per mile for flume, or 0.2841%.

On the Twelve-Mile Face there is about two miles of ditch in bad ground. To protect the lower bank 6000 ft. of cribbing was necessary. The grade is 4 ft. per mile. In the Nome region, where ditch construction has been more vigorous than elsewhere in Alaska or in the Yukon country, and where frozen ground obtains, some of the ditches have a grade of 3 ft. only. In a flat country such as that of the Seward Peninsula the upper bank of the ditch is not made steep and it is found best to use a ditch of wide cross-section, say 30 to 50 ft. in places. The ditch is cut to 30 ft., and becomes worn to 50 ft. As the frozen dirt thaws in concave form the moss droops over it. If the bank is not too steep nor too high the moss will hold together and eventually blanket the bank so as to hold the frost. The worst ground is that in which not only layers of ice but nearly vertical veins of ice extend through the moss and muck, so as to afford a channel for seepage as the ice thaws. These permit the water from the ditch to escape, and it will appear a hundred feet or more from the hillslope in the form of a geyser.

(To Be Continued.)

Next year, when the Bradley patents expire, the manufacture of aluminum, which has until now been in the hands of the Mellons of Pittsburg, will be open to the public. Many deposits of aluminum ore (bauxite) in this country have been waiting to be worked, and the chances are that the industry will take enormous strides within the next few years. The patents expired last year in Europe, and the metal is selling at about 13c. per pound, and the duty into the United States is 8c. per pound. Here aluminum has sold at about twice the price of copper, and is now about 23c. per pound, so the price should be halved in future.

PROTECTION OF INVESTORS.

The discussion held by the Pacific Coast division of the Mining & Metallurgical Society on November 21, 1908, was published in part in our last issue. It is here continued. The trend of the discussion was mainly toward ascertaining what information was due to the shareholders and how it could best be given in the reports issued by the management.

T. A. Rickard.—If you give tonnage without giving the yield per ton, you give no idea as to the value. In other words, you should not alone go through the motions of giving information, but you should give information in the way that you would give it to your own partner.

George W. Starr.—Suppose a mine is producing very well, and that ore is taken from certain parts of the mine; the manager is nursing certain parts of his mine and the investor does not know it. He gives his report out and states that he has got 500,000 tons of ore. If you don't give the value of that tonnage, it is misleading to the investors; perhaps a great many tons of ore are actually worthless.

Charles Butters.—At our mine at San Sebastian, in Salvador, the manager furnishes the secretary with a plan, and on that plan the mine is blocked out in small sections, and on every block is marked the number of tons and the value of the tons in that block. In the report he adds those blocks together and averages all the tons. A man who gets our report would find from it that we had so many tons of ore of a certain value; that would be the only figure given. If he wished to refer back to the little plan furnished with it, he would find out how the total was determined. The detail is all there, and that detail is made up from assays. We followed this system for about five or six years in this mine, in which the ore is high-grade. We found that the number of ounces of gold that we had estimated would always average as anticipated. As a rule our approximate grade has been lower than the blocks showed, but we got more tons.

T. A. Rickard.—Of a lower grade?

Charles Butters.—Of a lower grade than we had estimated: Yes. The number of ounces of gold that we estimated was nearly always correct.

T. A. Rickard.—Give us your views. What information do you think should be given to the shareholders?

Charles Butters.—My idea is that the manager should make himself responsible for every block of ore in the mine. He must have determined the facts from his assays, and the stockholder ought to be able to look back over the reports and maps and be able to find the information he wants. That information should be so specific that if the investor wished, he could review the operations for a series of years. From our plan we could find out that the estimate of the manager at San Sebastian had come out pretty fairly.

T. A. Rickard.—How soon should it be given? It might be a *post mortem*.

Charles Butters.—It is given just as soon as may be, at the end of the year. We give it annually because we only make an annual report, and we only make up our tonnage once a year.

T. A. Rickard.—Then it wouldn't help the shareholder from a stock market point of view?

Charles Butters.—We never sell our shares.

Mark B. Kerr.—What should be considered ore 'in sight'? For instance, you are running a drift through an orebody, and you have ore in the face, and in a raise. The upper level may not be in so far as the lower level, yet you may have every reason to believe that ore will be cut there also. Of course, if you have a winze ahead of you from an upper level, the chances are that you could draw the lines straight through and give an approximate tonnage. That certainly would come under another clause; that would be 'partly developed ore,' but here in California, at least from my experience, they do not like to give detailed reports as to reserves, especially on the Mother Lode. There the costs are down pretty low, lower than almost anywhere else in the world. You cannot get the details of that cost. As a rule they are not published.

T. A. Rickard.—How much do you think should be told to the shareholders?

Mark B. Kerr.—That is another point. I agree with Bradley on that point. Everything that a manager considers important should be published. As a rule the report of a manager is edited too much, that is, he gives a detailed report, and in that report are certain items that it might benefit the shareholder to know. If the manager can report partly developed ore—possibilities—that would give a better general idea of the value of the mine than just simply putting in ore that is actually exposed on four sides. I think that estimates of partly developed ore and of possibilities should be given to the shareholders.

T. A. Rickard.—To what extent is it practical to do that?

Mark B. Kerr.—I think it is practical to publish the greater part of the information. They can state the ore in reserve and the value of that ore, and the partly developed ore and its value.

T. A. Rickard.—To what extent do the president and directors of companies here consult you with reference to giving such information to investors?

Mark B. Kerr.—They don't want that published. The principal objection is to the publication of working costs. Two or three years ago I was discussing with the directors of a mine on the Mother Lode; they said to me that they would prefer not to have the cost mentioned because if the men in the mine had an idea that this ore was being mined so cheaply, and that possibilities were so good, it might create trouble: they would assume that the company was able to pay them more wages. It might lead to a strike. So the management did not like to publish the amount of ore in reserve or the costs of operation.

J. N. Nevius.—Is it not a question of affecting the stock?

Mark B. Kerr.—In the case mentioned the reason given was sincere. The mine was not quoted on the market. The decision was based upon the labor conditions, without question.

J. N. Nevius.—I had this in mind: We all, of

course, have observed that the value of the stock of a mine quoted either on the listed exchanges or on the curb, does not reflect the intrinsic value of the mine. The price does not rise and fall necessarily with the change in the condition of the mine as represented by the ore-values and probable life of the mine. Such a report as we are discussing—a carefully prepared estimate of the actual condition of the mine—would affect the value of that stock. It would steady the market value of the stock by enabling the public to buy and sell on an intelligent basis, instead of on the strength of rumors advanced by those interested only in manipulating the stock. It would tend to prevent such manipulation and to give to mining stocks a negotiable value they do not possess at present. I assume that it is the sense of this meeting to neglect the stock-values and to give consideration to the technical part of mining, and it seems to me that the manager and board of directors of a mining company bear to a certain extent the same relation periodically to their stockholders as a consulting engineer bears to his client. If any of us as a consulting engineer is operating or directing the operations of a mine, we are obliged to render an estimate of ore reserves and cost-sheets. Now then, from a technical point of view—not the stock point of view—should not a mining company render to its stockholders, for the same reason that the consulting engineer renders to his client, a report showing the exact reserves of a mine and the cost-sheets? I think it should be done once a year.

Charles Butters.—In estimating ore reserves, Mr. Bradley, in a mine, from year to year, don't you find, if you look back over a series of years, that after all it takes a good deal of experience to project an estimate? In other words, in order to make an accurate estimate that a man ought to be acquainted with the mine before his estimate has real value; that a continuous knowledge running over some years in the same mine is important?

F. W. Bradley.—I think that is very true; a stranger to a mine cannot make as good an estimate of the ore reserves and of the probable ore reserves as a man who has been long familiar with the mine and who has worked it several years. A manager who carefully studies his mine by giving the underground work especial attention and who has worked it a number of years should know exactly what the mine is capable of producing. I am, of course, speaking of a producing mine and not of an uncertain prospect. For instance, one way of estimating the ore reserves would be to take the area of his orebody on a specified level; he will know whether that area increases or diminishes on the different levels and he will know what a particular area produces. Another way of estimating ore reserves in a spotty mine where the orebodies are in kidney-shaped masses irregularly scattered throughout a mineral-bearing zone, would be to learn the gait of the mine and its production of tonnage per vertical foot of depth. He can in this way make a close estimate as to what the mine will produce, but in order to do that the mine must have been worked for some considerable time. It would be difficult for an engineer who has no familiarity with the mine to make as reliable an estimate as the manager who has actually been extracting ore from the mine over a period of time.

Charles Butters.—The reason I asked that is because our Mr. Garthwaite in Salvador has been six or seven years estimating with great care the actual ore in sight and the probable ore in sight, and he has cut out now estimating the probable ore. He prefers now only to give actual ore, after six or seven years' experience.

T. A. Rickard.—I suggest that it is almost impossible to define 'probable ore,' almost as difficult as to define a "reasonable doubt," for instance. It is entirely a matter of the personal equation. One man calls a thing 'probable' ore; another man calls it 'assured' ore; another man, a little bit more timid, or it may be a little more cautious, calls it a 'possibility.' It depends also upon the mine. In one mine 'probable ore' is so reasonably certain as to be called 'ore in reserve.' On the other hand, in a locality such as Georgetown, in Colorado, you can examine a mine that may be making a steady production, and yet you might not find one month's ore in a reserve in that mine, and you might cut up your mine in 50-ft. squares and yet not be able to estimate accurately. All the work in a mine of that kind is done by leasing, and yet in the aggregate, during the year, they get a great deal of ore. Then you would have to fall back upon this scheme that Bradley has mentioned. In that way you can get an approximation. But in the end you will find that a man who is unacquainted with a district like Georgetown is absolutely helpless when examining a mine there.

Charles Butters.—Mr. Bradley, do you ever estimate 'probable ore' for your shareholders?

F. W. Bradley.—I give 'partly developed ore' and 'ore ready for stoping' as ore reserves. 'Ore ready for stoping' would be the manager's estimate as to the actual tonnage he can dig out at a profit and deliver to a mill or reduction plant. A manager could list as 'ore reserves' tonnage of a profitable grade that might have to remain in a mine as pillars. The term 'ore available for stoping' or 'for extraction' would compel him to exclude all pillars or ore necessary to be left as pillars, which cannot eventually be robbed. For instance, I would give as fully developed ore, ore that is ready for stoping. I would give as 'partly developed ore', ore partly blocked out but not available for stoping. For example, if a shaft were in ore and had been sunk from a level also in ore, there would result a block that I would call 'partly developed ore,' the dimensions of this block being made liberal or conservative according to one's knowledge as to the gait of the mine or as to how the mine had performed.

S. B. Christy.—It seems to me that unless one takes into account and allows for the recognition of partly developed ore, it would kill many good mines in process of development. As Mr. Rickard has pointed out, if you insist on allowing only for developed ore, it would be fatal to many good mines in process of development. In such mines, all that there is is partly developed ore. This difficulty might be met by requiring the manager of a mine to distinguish,

in his report, between developed and partly developed ore, and to hold the manager responsible and criminally liable for misrepresentations in his reports. That is, if he represents to the stockholders that the ore actually developed contains a given tonnage and assay-value, which afterward proves to be a gross exaggeration, he ought to be criminally liable. It seems to me that such a law would clarify the atmosphere very quickly.

T. A. Rickard.—I would like to suggest that there has been a good deal of discussion as to ore in sight, ore in reserve, and the like, and that the term 'ore ready for stoping' describes it better than any other phrase. That means ore that has been cut by drifts and raises. I don't know what the next step would be: Ore that has been 'partly developed'. There, again, you must define what you mean by 'developed'; men differ in their notions. You don't want to use a word that requires definition each time it is used. What you call partly developed another man might not think so. But 'ore ready for stoping' is pretty clear. When you sink a shaft or winze here and drive a level there, you have got practically two sides of a square.

S. B. Christy.—'Partly developed ore', or 'possible ore', or some such term might be used. The reasons for belief in the possibilities of the mine should be clearly stated; that is the point.

T. A. Rickard.—So, then, we start with 'ore ready for stoping'. That will express the idea to anybody. Then the next thing is to describe ore the existence of which is partly proved; let the engineer or manager explain to what extent the existence of that ore is proved.

George W. Starr.—The degree of probability.

T. A. Rickard.—Yes; in one case you may require a great deal of proof and in another very little. On the Rand the sinking of a shaft and the running of a drift would be all the proof that is necessary. In Goldfield you would have to do much more to establish the existence of a body of ore that could be considered assured.

George W. Starr.—In some cases the term 'ore ready for stoping' would be misleading for the reason that, in many mines, a good deal of stoping is done backhanded without any connection, and stoping would be carried on before connection was made. Whereas, if you would call it 'blocked out ore', or 'ore in sight'—

T. A. Rickard.—That is tabooed.

George W. Starr.—We understand what 'ore in sight' means. It is as far as we can see it.

T. A. Rickard.—We don't see it.

George W. Starr.—We have got it assayed and blocked, and it is practically in sight.

S. B. Christy.—Ore exposed on four sides.

George W. Starr.—But 'ore ready for stoping' is misleading.

S. B. Christy.—I think so, too.

T. A. Rickard.—In a mine where, as you say, you begin to stope from the back, the ore is so regular that you can assume that it continues upward.

George W. Starr.—Suppose that you are running your drift, and you start stoping right from the back of that drift, you will carry a great breast right up through. You will be running that before your drift is connected, and you can carry your ore across.

T. A. Rickard.—We are all evading the question. The question is how to protect investors.

Ernest A. Hersam.—It is important to define the terms we are using.

George W. Starr.—I think that one of the most essential things in valuing your mine is the quantity of ore that there is in that mine that you can figure on, and thus give to the investors the value and the tonnage of ore ready to stope. And I would suggest that we confine ourselves for a while—that is, if it is acceptable to the others—to discussing that question, because I think that is one of the most vital points of a mine, and one of the points that a stockholder should know.

Charles Butters.—I did not quite understand you, Starr.

George W. Starr.—I think one of the most vital points for a stockholder to know is the amount of ore there is in a mine and the value of that ore, so that in discussing this question we should consider the form of report necessary.

T. A. Rickard.—Yes, of course, we agree that that is important, but the practical question is as to when and how the shareholder is to get the information. If the information is given in an annual report, which gives the story of the mine up to the end of December, and the report reaches the shareholder the first of June, he has got a graceful *post mortem*. It won't do him much good.

George W. Starr.—It certainly will if he has ore that will last over that period.

T. A. Rickard.—In some mines, yes; but in most cases he would be more interested in learning what had happened at the time than six months after the report was written, as affecting the value of his interest in the mine.

S. B. Christy.—That is the important point; for if the management had the information promptly, and the stockholders had it six months later, you can see what a chance there would be for speculation. It would be possible for those 'on the inside' to do anything with the stock of that company.

C. C. Derby.—I do not see why such information cannot be furnished the stockholders promptly, at the end of the fiscal year or for such periods as may have been determined. In several cases where I have heard complaint made by stockholders regarding the tardiness of the appearance of their reports, it was not the fault of the manager, as their information had been furnished promptly on the completion of the period to be reported on. At most mines it is possible to have all the data necessary worked up to the end of the last month, so that in a short time thereafter the manager can have his report ready to hand to his home office for distribution to the shareholders. It is then the duty of the main office to transmit the information promptly to those entitled to receive it. As a rule I think those in charge of the main offices are more at fault than the managers in direct charge of operations, for delay in furnishing reports to shareholders. In most instances the

manager can, and should, submit his report in short order. The shareholders in a mine are the owners, and are certainly entitled to all the information regarding their property that may be possessed by their employees, from the president down.

S. B. Christy.—I think it would be better to confine ourselves to our text, and find out, first: What are the general items of information that should be in a report? I think we are all agreed on the fact that the tonnage of ore actually developed and its value, constitute the first essential item. Second, it seems to me that there should be in the report itself sufficient data for any investor to check the calculations and conclusions of the manager, and see whether or not they are borne out by the facts given. For example, it should be stated how many tons of ore are exposed on at least four sides; then how many tons of ore are exposed on three sides; how many tons on two sides; and how much ore opened up on only one side. The distances at which the samples were taken, the method of sampling, the width of the vein at the points where the samples were taken, in detail or in averages for each block—these facts should be given, together with the dollar-feet, in detail or by averages, for each block of ore exposed. If this were done, and the manager were aware of the fact that each investor had the material for analyzing and criticizing his report, either in person or through the employment of a competent expert, it would do more than anything else to secure the proper and intelligent development of mining properties, and would be also an effective guarantee against fraud.

C. C. Derby.—I think Prof. Christy's definition for 'ore in sight', of 'ore exposed on four sides', is better than Mr. Bradley's term of 'ore ready for stoping': Take, for instance, our cinnabar ore, as it occurs in most of the mines in this State; as soon as ore is struck in a drift and the face can be advanced sufficiently beyond the point of encountering the ore to permit of stoping, stoping is begun. We do not attempt to develop the ore, for the reason that it occurs in such irregular bodies and masses that it is almost impossible to do so. So that the definition for 'ore in sight' of 'ore ready for stoping' would not convey the same meaning as 'ore exposed on four sides', when applied to the usual method of mining cinnabar ore.

S. B. Christy.—In that case it would still be possible to say it is exposed on two sides or on one side.

C. C. Derby.—We would call any ore 'ready for stoping' as soon as we cut it in a drift.

J. N. Nevius.—You couldn't say how many tons.

E. P. Kennedy.—The prime object in working a mine is to produce as large profits as possible, while not neglecting to exhaust the probabilities of finding ore. The dividing up of ore into blocks to accurately estimate its value may, or may not, conform to the most economical method of working the mine. I shall call attention to the fact that we are speaking of a mine and not a prospect, and therefore would consider exposing ore on four sides for the purpose of accurately determining its quantity and value as an unnecessary expense. The history of the mine and an intimate knowledge of the vein, plus two exposed faces, and sometimes with but one, would, in some cases, give sufficient basis for estimating the value of a block of ground, and often would be a better basis for estimating than the mere sampling of four exposed faces. The accuracy of the estimate obtained from sampling four exposed faces of a block of ore depends largely upon the mode of occurrence of the ore, and the size of the block.

The term 'ore ready for stoping' conveys the idea that the ore is ready to extract, the aim in all development work. We presume a mine is opened up to produce the best economical results, and in so doing the ore may be exposed on four sides, but the fact that the ore is not so exposed implies that this is not the most economical way to develop ore. The tons and value of 'ore ready for stoping' may be based on the assay and widths of samples taken from one or more drifts, together with the knowledge of the vein; or may be based on the assay and widths of samples taken from each of the four exposed faces of a block. The term 'ore ready for stoping' expresses the practical conditions as they exist, in so far as it is within the ability of the manager to estimate.

T. A. Rickard.—You get this contrast: On the Rand the running of a drift or the sinking of a shaft proves the ore, while in another case—the extreme case that I mentioned in Colorado—you might block it out on four sides, and yet you could not estimate it satisfactorily; so that the number of sides on which ore has been proved does not determine the amount of it with finality.

J. N. Nevius.—You assume that there is ore there ready to stope.

S. B. Christy.—It seems to me that the investor should have access to all the information that the superintendent has. For instance, in certain kinds of formations where there is known to be a well defined ore-shoot, we all know that the opening up of a block of ore only on one side may be sufficient to enable a reasonable estimate to be made of the value of the block of ore. Of course, the figures represent probable rather than assured values; but the man investing in the property gradually comes to know that, and he takes his chances on it. The point is that in estimating the value of ore in a mine, all the evidence necessary to form an estimate of the volume of ore and its richness ought to be given.

E. P. Kennedy.—It ought to be the property of the shareholders.

T. A. Rickard.—In other words, the report should be a sincere honest report, and the manager should give the information so that it conveys the maximum of information, just as if I were writing to you, and had to tell you what was in a mine, I would try to convey the information to you in as few words as I could.

S. B. Christy.—What I have in view is not that you should force the manager, necessarily, to expose the ore on all four sides. But if he exposes it only on one or two sides, and then tells you that there are so many tons of ore 'in reserve', you ought to have the information that it is not really exposed fully, in order that you may understand that you are taking

certain chances as to what its value may prove to be in future. It would clearly be a mistake to force every mine to be worked in the same manner; but the investor ought to know the way in which it is actually being worked.

E. P. Kennedy.—I think there would be a lot of unnecessary development work if you had to block it out on four sides.

Mark B. Kerr.—Very often you are running a drift, and you are way ahead in that lower strip, and you know your orebodies are strong. You make a 'stoping raise'—I have used that term many a time—that stope goes up 400 ft. before it connects with the level above, but that is just as much a part of the development of the orebody, and it would be mentioned as 'probable ore' just as much as if it were developed on four sides, and there would be only two sides developed, that is, the raise and the drift.

S. B. Christy.—It has often been said that language has been given us for the purpose of enabling us to hide our thoughts; and it seems to me that many of the reports I have read on mines appear to have been written for the purpose of concealing the real condition of the mine from those asked to invest in it. What we want to get at is some form of statement that will force the manager to give the stockholder such information as will enable him to form an intelligent idea of the value of his investment.

Whitman Symmes.—If we do not try to elaborate too much, I think we can have a standard form for mining reports. There are certain questions that every mining report should answer, and Mr. Bradley's question is certainly one of them. The report should state the amount of ore actually developed in the mine and the amount partly developed. Where ore is partly developed, that is, where it is exposed on less than three sides, I think that the engineer should state his reason for including it in his estimates. It is not necessary for ore to be entirely blocked out before it can be considered as a reserve. For example, I was called upon to estimate the available tonnage in a number of small limestone lenses that were to be used by a cement company. Very little development work had been done and they were exposed only on the surface, but it would have been mere sophistry to have stated that there was not a dependable quantity of limestone already exposed. It was an easy matter to determine the general geology of the district and to decide that the limestone extended to an average depth of at least 100 ft.; upon that basis a definite statement of the amount of limestone exposed in the deposits was made. But the depth assumed, and the reasons for the assumption, were clearly stated in the report; and it would not have been fair to the stockholders to have given them a definite estimate without briefly stating the data and reasons upon which the estimate was based. I do not think that any standard definition can be framed which will in all cases fairly apprise the reader what is meant by 'partly developed ore', but if the mining engineer gives briefly the reasons for his assumptions, then the whole matter is made clear. In many cases, the reasons given will be that on the levels where the orebody is partly developed the vein and chimney of ore are found to continue with the same strength of formation, and that the ore has the same habit and value. But a standard form of mining report should be so framed that it is impossible to evade noting such points. The failure to give definite figures, and the definite assumptions upon which those figures are based, as to partly developed ore in a mine is one of the commonest causes for personal loss in mining ventures.

S. B. Christy.—It is a well known principle that always governs in the writing of all good scientific treatises that the author should give his facts absolutely distinct from his conclusions, and that the facts should be so clearly and fully stated that any other competent person, looking over his work, should be perfectly able either to verify his conclusions, if correct, or, if they are incorrect, to draw opposite conclusions from the same facts. And this should always be possible in a mining report. The stockholder should not be forced to depend on the mere opinion of the mine manager; he should have the facts stated so completely that he can either judge for himself the value of the mine, from the report, or else have the report reviewed by some competent expert. While most of the stockholders may not be able or willing to go to this trouble, and might be willing to gamble on the opinion of the manager, the very fact that some one stockholder may be able to prick the whole bubble and expose the deception would be a good check on the unscrupulous manager, as he would find ruin and State's prison staring him in the face if he misrepresented the facts.

J. N. Nevius.—I think that is a very important point; in a mine report the facts should be given separately from the conclusions.

T. A. Rickard.—The highest compliment you can pay a description is that it faithfully sets forth the facts. I remember a paper that Arthur F. Wendt wrote in the Transactions of the Institute years ago, and he gave the facts so faithfully that he gave all the evidence necessary to controvert his own conclusions. As a rule the facts that people give are more valuable than their conclusions, if the facts are sufficiently complete to enable the other man to make his own conclusions. That was an excellent paper of Wendt because the conclusions did not take up much space.

Ernest A. Hersam.—The report should contain a concise and definite statement of the manager's opinion, but there are possibilities and contingencies on either side. The probabilities have a definite value, either a positive one, or a minus one; but they get their value from the element of chance. If the stockholders know the circumstances and the conditions, they can then decide for themselves what risks they are willing to take.

S. B. Christy.—But there is another phase of the question which I think should be considered; that is, the possible effect of a true statement of the fact that there was actually, at a given time, no ore 'in reserve' in a mine. The necessity of making such a statement would ordinarily, of itself, raise in ques-

tion the competence of the management; and yet it may occasionally happen that the management of a pockety mine may be honestly forced to make such a statement, though the mine still has a future before it. The publication of such a report might create a panic, and destroy the value of the stock; but even supposing that it did happen, the result would be that the timid investor would sell out, lowering the value of the stock to a nominal figure. This, while unfortunate for the timid investor, may be the best possible thing that could happen for the public in general. It would enable the more far-sighted owners to buy the stock at a low figure and keep up its production. So far as the long life of the mine is concerned, it might be well to get the weak members out, and give those having faith in the future of the mine a chance to control and manage it. It should, however, be a criminal offense to misrepresent the condition of a mine for the purpose of "freezing out the outsiders." The very fact that previous reports of the manager were in the hands of all the stockholders would do a great deal to prevent such swindles. In short, I believe that publicity is the best remedy for corruption and inefficiency in mine management, as well as in other industries. Nothing develops honesty in a man more quickly than the realization that he is held responsible for his actions. It is a well known axiom of good government that power and responsibility must always go together. Nearly all of the corrupting influences of our modern corporation life are due to the fact that the managers and directors of these corporations are able to escape responsibility for their acts. And this growing evil will never be checked until those in power realize that criminal prosecution and punishment will certainly and swiftly follow all abuses of their powers and responsibilities.

Mark B. Kerr.—I would think that any shareholder in a mine, after the facts are given to him, should have the possibilities and the probabilities of the mine also given to him, and then the conclusions after that. Otherwise there would be an advantage for those on the inside who have that information.

E. P. Kennedy.—Men are apt to draw their own conclusions. The manager is in a position to draw the right conclusion.

Mark B. Kerr.—Because after all there is a great deal of chance to be taken in a mine. These orebodies are not always straight and easy to mine. Sometimes they pinch out to a mere thread. Then, again, a fault may occur. Of course, all those things, if they are taken into account as probabilities and possibilities, will give a shareholder a fair chance to see what sort of a risk he is taking. The manager should help the shareholders to determine the value of their interest. Then it is a square deal, and if the shareholder gets timid and drops out, he at least has all the possibilities before him, and the directors have not the advantage of inside information.

H. W. Turner.—I think that the point of view of the shareholder has not been brought out clearly in this discussion. In the first place, the manager has the confidence of the shareholders. He is appointed manager because they think he has good judgment, and can operate the mine economically, and they will accept his general conclusions in nine cases out of ten without investigating the details of the report. Of course, full information about the mine should be given for those investors who want details or who have engineers who can size up the details for them. But I feel pretty certain from my limited experience that the investor depends chiefly on what the manager says. It stands to reason that if the manager is competent his estimate is worth the deductions of all the shareholders put together. They would hardly care to vary much from his opinion. If the shareholders lost confidence in the manager, they would drop him and get another. I think, therefore, that the manager should be particular in his estimate of the developed tonnage in the mine, and its value at the time of his report, recognizing that his general conclusions will be taken by most of the shareholders as reliable, not only as to developed ore, but as to probable ore.

S. B. Christy.—That is, the existing state of affairs?

H. W. Turner.—Yes, and as to probable ore they would also consider him the best judge.

S. B. Christy.—Do you think that the existing system is satisfactory?

H. W. Turner.—You take a report like those of the Bunker Hill & Sullivan; that is very satisfactory.

T. A. Rickard.—We might put it down as the sense of this meeting that we regard it as highly unprofessional for a mining engineer or a mine manager to give a report calculated to mislead the stockholder, even though it be in favor of the Board of Directors. Some expression of opinion should be made.

F. W. Bradley.—We have only discussed the first part of the question. We have only covered the first paragraph.

S. B. Christy.—We consider it the duty of the management of a mining company to furnish the stockholders with the information in their possession, or sufficient information to enable them to have a knowledge of the mine and a knowledge of the average value of the ore exposed in the mine, with the reasons on which the statement of fact is based.

T. A. Rickard.—Yes, except that you have used the word 'management', which is general, and we are concerned more with the individual engineer than with the management.

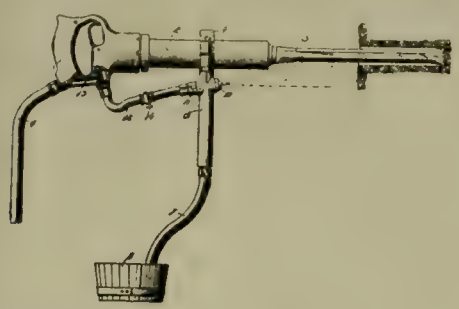
S. B. Christy.—Well, the circular says 'reports of the management', does it not? It is agreed that the reports of mining companies should contain sufficient information to inform the stockholders as to the amount and value of the ore exposed in the mine, at the time at which the report was written, together with the information upon which these calculations are founded.

Earthquake shocks of violence are usually preceded by fore-shocks over the epicentral region, that is, vertically over the point of greatest strain, according to demonstrations from studies made in Japan by F. Omori.

MINING AND METALLURGICAL PATENTS.

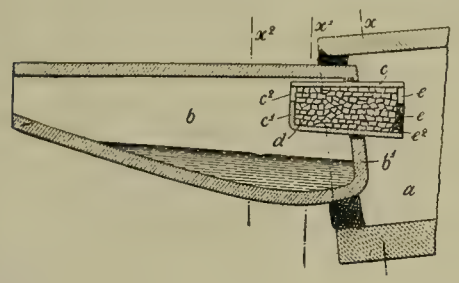
Specially reported for the MINING AND SCIENTIFIC PRESS.

WATER-SPRAYING DEVICE FOR PNEUMATIC TOOLS.—No. 905,387. Albert H. Taylor, Easton, Pennsylvania.



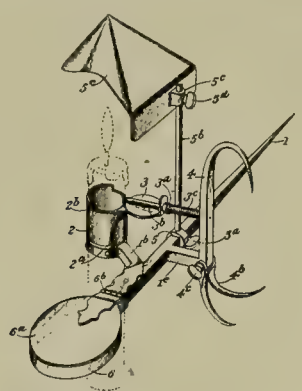
A water spraying device for pneumatic tools, comprising a hollow rotating handle communicating with a water supply, and an ejector carried by the handle, for spraying water onto the desired spot, said ejector having its discharge nozzle in communication with the interior of the handle and its force nozzle in communication with the air supply.

PROCESS OF EXTRACTING ZINC.—No. 905,753. Edward H. Shortman, Bloxwich, England.



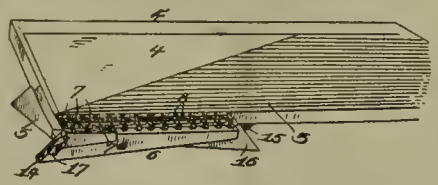
The improvement in the art of extracting zinc by distillation which consists in passing the metallic vapors prior to condensation through a lead-intercepting medium consisting of anthracite or hard non-bituminous coal or hard coke in a condition that renders it chemically inert but active by its physical or mechanical properties.

MINER'S SAFETY-CANDLESTICK.—No. 906,449. Frederick Muenger, Hill City, South Dakota.



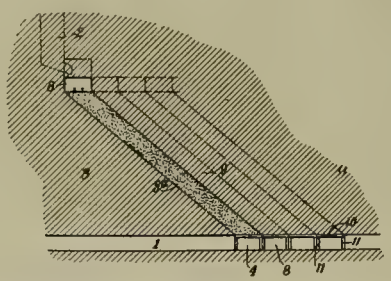
A miner's candlestick comprising a member provided with a spud at one end, and at match receptacle at the other end, an intermediate candle-holder at one side, a hook opposite the candle-holder, and a scrap-hook adjustably attached to the bottom of said hook, a rod attached to said hook and projecting toward the holder, an extinguisher slidably mounted on said rod, and a spring for moving said extinguisher toward the holder.

ORE-CONCENTRATING TABLE.—No. 906,464. Claude Sherwood, Black Bear, Idaho.



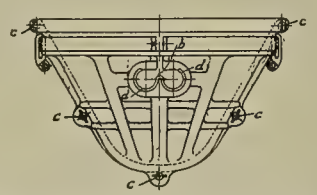
The combination of a concentrating table, a series of separate pockets extending along the discharge side of the table and each having a series of distinct outlets, a series of separate troughs to receive different classes of material from the outlets of the individual pockets, and shiftable means with an opening to register with the respective outlets for directing the different materials entering each pocket through the outlets into separate troughs.

METHOD OF MINING.—No. 904,021. Martin Schwerin, Elizabeth, New Jersey.



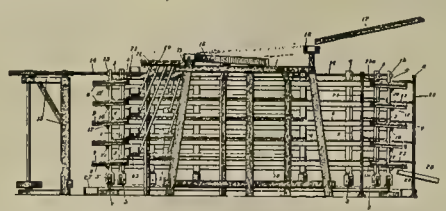
The herein-described method of mining consisting in connecting a drift and an open-ended waste-chute by successively slicing on an incline a minable body which is between the drift and chute, and in filling the space formed by the slicing operation whereby the minable material above said space is supported by the filling.

LADLE FOR CARRYING AND TIPPING BLAST-FURNACE SLAG.—No. 906,117. John H. Dewhurst, Sheffield, England.



A slag ladle consisting of two parts divided from each other vertically, means for holding the two parts together and trunnions, the joint between the two parts extending longitudinally of the ladle and in a plane and at right angles to the vertical plane in which the trunnions lie, substantially as described.

CONCENTRATING APPARATUS.—No. 906,205. Wilton E. Darrow, Sutter Creek, California.



A concentrating apparatus comprising a plurality of circumferentially disposed upright supports carrying inwardly projecting arms spaced apart in tiers, each tier carrying a circumferentially disposed inclined ring, a plurality of circumferentially diposed trays flexibly connected with said rings and being adjustably supported by said rotating supports, and pulp supply discharging on said trays.

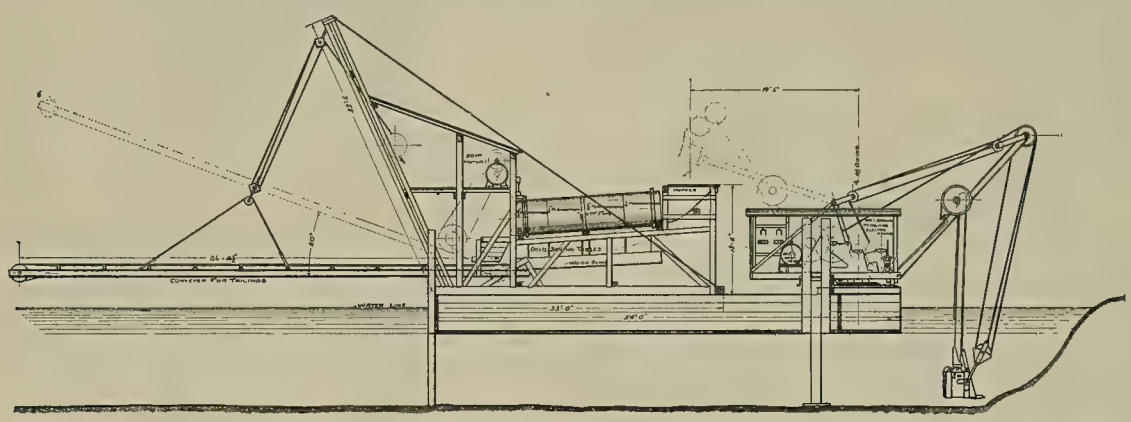
Special Machinery for Placer Mining.

Written by E. L. Byron.

Many experiments have been made with different kinds of machinery for placer mining, and since the days of the one man and a pan, many successes have been made with improved devices, so that in this day of advancement, placer ground that a short time ago was considered impossible, is now being worked at a profit.

While it is undoubtedly true that the most common, and up to the present time, perhaps the most successful method of working placers, especially in the Western States, is by bucket-dredges, yet owing to the large cost of the plant, the small operator has been practically shut out from this form of mining enterprise. Again, there are many gravel deposits to which a bucket-dredge is not adapted, especially where the bedrock is uneven. Most of the gold in this class of mining is bound to be found in the crevices in the bedrock, so that the top crust of such bedrock must be removed to get the richest part of the deposit, and owing to the peculiar construction of the elevator-bucket dredges, it is impossible to remove all of the gold that lodges in these crevices.

The accompanying drawing shows a special dredge, with gold-saving machine attachments, designed to fill the requirements stated. All the machinery is mounted on one boat and is compact in every respect; two men are needed



when making an output of from 200 to 1000 cubic yards of ordinary placer ground per day of 10 hours.

This outfit consists of a revolving shovel, that is, a power-shovel mounted on a pivot so that it swings through a complete circle, thus allowing it to dig and dump on all sides. The shovel is mounted on the front end of the boat; it digs the material in front and swings through a half circle, depositing the gravel in the hopper of the gold-saving device mounted on the rear end of the boat.

The gold-saving part of the machine is built to take care of the material as fast as the shovel will dig it. The shovel excavates the material and delivers it into the hopper in the rear. All of the gravel not too coarse passes through the hopper into the revolving screen. This revolving screen has perforations through which the material passes, the gold particles passing into the shelves lined with cocoa-matting and the waste out into the sluices and up over the conveyor-belt to the dump. Rippers are provided in the sluice-boxes to recover any gold that may have passed through the matting.

This machine can not only be used in wet placer mining, but all machinery can be easily removed from the boat and mounted on standard trucks or traction-wheels, and operated on dry placers. The change converts the machine into a standard revolving shovel for all classes of dry placer work, and the gold-saving machinery being mounted on trucks or traction-wheels and attached to the rear end of the shovel, makes it practically a duplicate outfit of the dredge machine. This machine is arranged for either steam or electric power. It is also constructed in such a manner that it can be 'knocked down' and hauled by teams through a mountainous country.

The machinery for this new gold dredge is manufactured by the Vulcan Steam Shovel Co., of Toledo, Ohio. When used as a dredge, the boat is ordinarily built on the ground, and working drawings are furnished by the manufacturers. If, however, timber is not to be had in the immediate vicinity, all material for the boat can be framed at the works of the manufacturer, and shipped with the machinery in a 'knocked down' condition, to be re-assembled on the ground.

Publications Received.

Any of the books noticed in these columns are for sale by or can be procured from the Mining and Scientific Press.

Mechanical Engineering of Steam Power Plants. By Frederic Remsen Hutton. 3d. ed.; 8vo.; 866 pp.; ill.; index. John Wiley & Sons. 1908. Price $5.

The name of F. R. Hutton is so well known in the field of mechanical engineering, and his book on Steam Power Plants has so long been a standard of reference, that interest will be quickened by the announcement that the present edition is in effect a new work. It is not a mere revision; it has been entirely re-written, none of the old plates being retained. The points subject to elaboration in the new edition are chiefly the steam-pipe, and the many auxiliaries which have become so important in the economy of modern plants; the steam-turbine also receives treatment appropriate to its increasing importance as a factor in power-generation.

Commercial Handbook of Canada. Heaton's Annual, for 1909. Edited by Ernest Heaton and J. Beverley Robinson. 8vo.; 418 pp. Heaton's Agency, Toronto. Price $1.10.

This contains all that a national reference annual is supposed to cover, and some things besides. For example, the existing tariff schedules and regulations are given in detail, as are also the Provincial regulations affecting foreign corporations; trade-mark, patent, and copyright laws; fishery treaties; boiler regulations, and the like. There is included a mineral directory; and a trade register covering the principal towns of the Dominion. A résumé of the mining laws would have added value to the work.

Smoley's Parallel Tables of Logarithms and Squares. By Constantine Smoley. 5th ed., revised. 8vo., 130 pp. Engineering News Publishing Co., New York. 1908. Price $3.50.

The additions to this well known handbook for the structural engineer consist of a multiplication table for rivet-spacing, common logarithms of numbers from 0 to 10,000, with tables of proportionate parts, logarithms of the sine and tangent from 0 to 3°, and of the co-sine and co-tangent from 87 to 90°, varying by 10 seconds, with proportional parts for seconds; logarithms of the sine, co-sine, tangent, and co-tangent for each minute of the quadrant, with proportional parts for seconds; and a table of natural functions. The work is a sort of universal calculator, available for computations in either the English or metric systems.

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EDITORIAL.

DIVIDENDS of mining companies operating on the Rand aggregated £8,753,000 in 1908, as compared to £7,131,000 in 1907; this is an increase of about 23 per cent. The most productive mine in this regard was the Robinson, which distributed £825,000, and next came the Simmer & Jack, with £675,000. The list includes 53 companies, of which five appear as dividend-payers for the first time.

OWING to a strike among miners, the Broken Hill Proprietary mine is idle and 4000 men are out of work. Wages were raised when the price of lead advanced and the company wanted to reduce wages when lead went down. The men did not see it that way and struck. Other mines at Broken Hill are not affected, but the Proprietary is an important producer and the lead market ought to be strengthened by the event.

COBALT has done well of late, and even the Nipissing has recovered from the fiasco of two years ago. In four years the silver mines of the Cobalt district have yielded $20,800,000, and out of this they have paid $11,627,000 in dividends. That is a splendid record. The ore produced has been small in tonnage but high in value: 47,178 tons, averaging $440 per ton. During 1908 Cobalt yielded $9,100,000, despite the drop in silver. In addition to its own productiveness, this mining centre in Ontario has stimulated prospecting over the wide region of Canada stretching from the Great Lakes to Hudson Bay.

SHARES of Oroville dredging are at a discount in London, and there is much disappointment over the unsatisfactory outcome of this Anglo-American enterprise. While the nucleus of the original dredging ground was good, the Bear River tract is considered locally to have been much over-rated. Inferences from drilling have not been confirmed, for that preliminary but essential method of testing dredgeable ground was not as well understood in 1905 as in 1909. We are informed that the best of the area has been worked during the past two years, so that the reserves have been seriously trespassed. The original estimates and reports relating to this undertaking were prepared by those who were promoters of the company; comment is superfluous. It is an old stupid blunder, repeated again and again. Neither the ability nor the good faith of the projectors is questioned, but it cannot be doubted that a serious error of judgment explains why the pound shares are unsaleable at eight shillings. Elsewhere, on the Yuba, the same manager is obtaining magnificent returns, and we regret, for the sake of the reputa-

tion of California in London, that the British are not more largely interested in that enterprise also. At the recent meeting of the Oroville Dredging company, it was announced that an option had been obtained on a large and valuable tract of dredging ground in Colombia, and that it was proposed to use some of the Oroville dredges and some of the Oroville experience in this new enterprise, hoping thereby to redress the balance of disappointment. This seems a good idea, if the shareholders have confidence in the present management; there is no reason why they should be timid in that regard if they are co-partners in the new venture. Incidentally we note that the examination of the Colombian property was made by Mr. C. H. Munro, who is now manager of an important group of alluvial mines at Nome. We are glad to be able to testify that his opinion concerning the prospective value of dredging ground is authoritative, for he is known to us to be both careful and experienced. It is possible, therefore, that Oroville Dredging, Ltd., may be resuscitated, and that an error of judgment may be retrieved.

WE NOTE that Major W. P. Richardson, president of the Alaska Road Commission, has appeared before the military committee of the House of Representatives to urge the voting of funds for the completion of the wagon-road from Valdez to Fairbanks, and for other pioneer work of the same kind. It is a pleasant duty to record our acquaintance with the nature of the work done by the Road Commission of Alaska and to give our unreserved endorsement to the request for Congressional support. The building of wagon-roads does not appeal to the imagination as much as the construction of railways, but in a new country the first is often more useful than the second; the wagon-road is a public highway, open to all; the railway is a licensed line of traffic controlled only too often in the interest of a few; one favors free competition, the other inclines toward monopoly. Alaska needs wagon-roads first, and railways later.

Depreciation of Gold.

Our contemporary at New York publishes a most interesting article on the supposed relation between the depreciation of gold and its cheaper production. The author of the article is Mr. W. R. Ingalls; he is to be congratulated not only on a scholarly discussion of an important subject but on the presentation in a lucid manner of an array of facts calculated to clarify future debates on a matter of prime importance. Mr. Ingalls shows by statistical diagrams that (1) there is no parallelism between the rise in the prices of commodities and the production of gold, (2) the rise in the production of iron has accompanied the increased production of gold, but in greater ratio, because (3) the advance in commerce and industry has exceeded the supply of metal. He easily refutes some of the dicta of supposed economists, and exposes the inaccurate statements of writers unfamiliar with the details of gold mining. Finally, he assigns the rise in commodity prices to complex causes, among which are exhaustion of natural resources, decreased efficiency of labor, extravagance of living, over-extension of enterprise, and failure of agricultural development to keep pace with the growth of population. Even those who do not accept all his conclusions will find that he has compiled a mass of valuable data, from which they can make their own inferences. It was high time that a few facts were introduced into a discussion that had become nebulous. Thus, another contemporary, also published at New York, discusses 'The Increase of Gold Production and the Increased Cost of Living' only to befog the subject. What illumination is likely to come from a writer who says that "at present, gold production, which was restricted in 1907, is now increasing more rapidly than ever and piling up so fast that the reserves of gold in Paris, New York, London, and Berlin are enormous." A pretty bit of reasoning this! In the first place the gold production of the world in 1908 showed but slight increase by reason of the effect of industrial depression upon the mining of copper, lead, and other metals with which gold is associated in ore deposits; and as to the reserves of gold in the banks indicating a big production of the metal, by the same token the gold production of the world must have risen suddenly and enormously during the recent unpleasantness when the banks deemed it necessary to call in their balances.

A good example of a local depreciation of gold by reason of the ease with which it is extracted from the earth, is afforded by Dawson during the Klondike rush, when the commodities of life were relatively, and momentarily, scarcer than gold 'dust.' Sugar fetched $1 per pound, flour $10 per sack of 50 pounds, potatoes 75 cents per pound; a pick was worth half an ounce of gold and a keg of nails could be exchanged for five ounces. Labor was worth $1 per hour and champagne $15 per pint. These high prices were due in part to the distance from a source of supply and the great cost of transport, but when men pay 50 cents for one dance and $15 for a pint of champagne, it may be assumed that money is coming easily. Long before the method of transport was improved or even the supply of commodities much increased, the waning of gold production, following upon the exhaustion of the shallowest and richest diggings, had depressed commodity prices by lessening the amount of gold to be squandered by successful prospectors. Moreover, in such a community of irresponsible adventurers there is at first no credit asked or granted. Everything is paid in cash. The gold 'dust' is taken from the 'poke' and weighed on the scales, in exchange for a pick or a drink, a loaf of bread, or a keg of nails. This is simple barter. At the same time and in the same place, the Indians exchanged fish for tobacco. As the mining camp becomes established, banks are started, mercantile concerns systematize business, and a complex structure of credit is slowly erected. Then comes another period of stimulation to the local mining industry, for the amount of capital available is increased by the loans obtained by the operators from the banks and from the public, through the medium of stock

issues. The introduction of a credit system enhances local prices.

Is not this true of the world at large? Civilized peoples do about 90 per cent of their business on credit; whether in the form of loans, notes, or checks does not matter; it is done on paper; and only 10 per cent is secured by metallic coin. At the great financial termini, such as New York, 95 per cent of the business of the banks is done on credit; at the division points, such as Chicago, the percentage is less, about 90; and at the branch stations, such as Seattle, the proportion of credit business is still smaller, until on the frontier men want to see "the color of their money." As civilization progresses confidence is established, an enormous and increasing proportion of transactions is effected by exchange of credits, until relatively only a few bars of bullion or a few sacks of gold serve to remind us of the small basis on which our pyramid of credit is reared. Panics diminish credit temporarily and make a call on reserves of gold coin. With diminution of credit gold appreciates and commodity prices go down; during periods of free credit and consequent expansion of trade, gold is less in demand for banking, and commodity prices advance. At the present time gold production is nearly stationary, the increased yield of South Africa balancing the diminished output of Australia and America. Credit shrank during the panic of 1907 and has not wholly recovered, the banking centres have withdrawn gold from the channels of trade, the index number of commodity prices has fallen from 2601 in June 1907 to 2168 in September 1908. This can be expressed in another way: the market value of a commodity is the number of dollars it fetches, that number is directly dependent on the demand for the commodity; if a man possessing credit does not utilize his credit, the demand for commodities declines; if he is impelled to make the most of his credit, he buys and prices advance. What makes men use their credit and become expansive—and expensive? The world has been going through a period of industrial development and consequent commercial activity. On the American continent especially the spirit of a people occupied in rapid and extravagant utilization of extraordinary natural resources has stimulated the desire to spend and be spent. New enterprises, promising inventions, fascinating opportunities for 'making money' rapidly and easily have led to the fullest use of the credit factor. In the interval the gold production has increased—for example, it has doubled in the last ten years—but while the proportion of increase has been remarkable, the aggregate of gold added to the world's stock has been relatively small when compared to the vast expansion of credit and the tremendous increase of business.

State Mine Inspection.

Mining has been little hampered in America by statutory regulation or by the mandates of inspectors. Few States possess such regulations, and fewer pretend to establish official inquisition of precautionary measures for preventing accidents in mines. Montana has taken the lead among the metal-mining States in exercising control in this regard, and Pennsylvania among the coal-mining States has elaborated a system of rules and inspection to a higher degree of efficiency than any other. A bill has now been introduced into the California Assembly for the appointment of an inspector of mines; this is a symptom of awakening interest in a subject that is likely to command increasing attention. Such measures are capable of harming industry, if the powers conferred be not carefully guarded, or of becoming a farce, or worse still, a basis for graft. In the case of the California bill the fairest criticism would seem to regard it as premature. It would look like an attempt to provide a sinecure for some political favorite did not Section 11 naively lay the prospective incumbent open to be "sued upon and recovery had thereon by any person aggrieved, injured, or damaged by reason of the failure by said inspector to perform the duties herein required." Moreover, the proposed act invests the inspector with no authority; he can recommend but cannot command, and no penalty attaches to disregard of his suggestions. The only semblance of compulsion lies in the fact that failure to comply would constitute *prima facie* evidence against the operator in the event of an accident. The appointment of a mine inspector without power would be to create a ridiculous supernumerary to be fed at the public crib; to endow him with authority unrestrained by specific regulations enforceable under adequate penalty would be to let loose an autocrat who would inevitably discover a money-value for mildness in his edicts. California has not yet taken the question of mine regulation seriously. The statute-book is cumbered by a feeble coal-mine act, passed in 1874, that would provoke a smile from infant Oklahoma; another earlier act prescribes an alternative exit from a mine more than 300 feet deep in which as many as 12 men are employed; one passed in 1893 provides for a uniform system of mine-bell signals; and there is another making it a misdemeanor to leave an abandoned shaft or pit uncovered or unfenced. It would be easy to point out many absurdities in Assembly Bill No. 294, but the passage of such an act in advance of legislation defining the duty of mine-owners in the protection of employees is not to be anticipated. As it stands, it pretends to require the inspector to discriminate between experienced and inexperienced operatives, without establishing a basis for ascertaining competency.

Legislation of this character needs to be well advised, or damage will ensue far worse than could arise from trusting to the instinct of self-preservation on the part of the miner, and to the instinct for avoiding damage suits on the part of the mine owner. The subject might properly engage the attention of the Mining and Metallurgical Society of America. Increasing pressure for restrictive legislation will lead to the passage of crude acts in many States unless intelligent guidance be given. Examination and discussion of the best examples of mine regulation abroad would furnish material from which lawmakers could draw for the framing of rational statutes applicable to American conditions.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

T. H. LEGGETT is in Mexico.

BEN. B. LAWRENCE is at Cobalt.

J. E. SPURR is at Matehuala, Mexico.

HENRY F. LEFÉVRE is at Beatty, Nevada.

FRED L. MORRIS is on his way to New York.

J. MORGAN CLEMENTS was at Baltimore recently.

W. W. ADAMS now resides at Oakland, California.

J. W. MERCER has returned to New York from Ecuador.

CHARLES T. MIXER is examining mines in Sinaloa, Mexico.

E. H. GARTHWAITE has returned to Oakland from Durango, Mexico.

FRANCIS DRAKE has been examining borax deposits in southern California.

JOHN O. NORBOM, lately in South Africa and Norway, has returned to California.

C. W. PURRINGTON is in the Mediterranean and will reach London on January 24.

O. B. PERRY is expected in New York on his return from Europe about January 22.

J. W. BRYANT, of the Tyee Copper Co., was in San Francisco on his way to Mexico.

SIDNEY JENNINGS has been appointed consulting engineer to the Boston Consolidated, Utah.

D. A. MCDONELL, manager of the Butters Copala mines, in Sinaloa, Mexico, is in San Francisco.

EDWIN A. AUSTIN, on his return from the Yukon, has gone to Colombia, to return in a couple of months.

HERBERT HAAS has resigned from the Union Iron Works and will resume consulting metallurgical practice.

T. H. OXNAM has just returned to Los Angeles from the Gold Mountain mines, San Bernardino county, California.

A. E. DRUCKER, lately metallurgist for the Oriental Consolidated Mines Co., has left Korea on a tour of the world.

ALEX F. REID, lately assayer and metallurgist to the Montana Mining Co., is at present at Victoria, British Columbia.

MARK B. KERR has been appointed consulting engineer to the Pittsburg Gold Flat Mines Co., near Grass Valley, California.

ROBERT A. KINZIE, general manager of the Alaska-Treadwell mine, was in San Francisco this week, on his way to Washington.

H. C. SCHMIDT has resigned from the management of the Cia. Metalúrgica Nacional, of Matehuala, and has opened an office at Monterrey.

E. C. KNOWLES and PAUL W. AVERY, of Deadwood, South Dakota, are in San Francisco on a month's leave of absence from the Homestake.

WILLARD S. MORSE has not resigned from the A. S. & R. Co.; it is his son Willard V. Morse, who was at the Aguascalientes smelter, in Mexico.

H. A. SHIPMAN leaves for London in a few days. He will proceed to the Gold Coast Colony, West Africa, where he has accepted a year's engagement.

A. P. LOW, R. W. BROCK, W. G. MILLER, and F. D. ADAMS attended the Baltimore meeting of the American Association for the Advancement of Science.

The Colorado Scientific Society held its annual dinner at the University Club, Denver, on January 2. FRANKLIN GUITERMAN, the president, was in the chair.

F. O. HARVEY and A. G. B. WILBRAHAM have entered into partnership as consulting mining engineers, with offices at 2 Laurence Pountney Hill, London. Both have been connected with the Mason & Barry copper mines in Portugal, Mr. Harvey some years ago and Mr. Wilbraham more recently.

Latest Market Reports.

LOCAL METAL PRICES—January 21.

Antimony	12@16c	Quicksilver (flask)	$44½@45½
Casting Copper (scrap)	8½@13½c	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 14. £. s. d.	Jan. 21. £. s. d.
Camp Bird	0 15 3	0 15 3
El Oro	1 5 7½	1 2 6
Esperanza	3 5 0	3 3 0
Dolores	1 10 0	1 10 0
Oroville Dredging	0 7 9	0 7 9
Mexico Mines	4 18 9	4 17 6
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Jan. 15	14.00	4.18	5 15	52⅜
" 16	13.87	4 18	5.15	52⅜
" 17	Sunday.	No market.		
" 18	13.87	4.18	5.15	52⅞
" 19	13.81	4.18	5.15	52⅜
" 20	13.75	4.18	5.14	52
" 21	13.75	4.18	5.14	51⅜

SOUTHERN NEVADA STOCKS.

San Francisco, January 21.

Atlanta	$ 16	Laguna	
Belmont	97	MacNamara	35
Booth	25	Manhattan Con	5
Columbia Mtn	18	Midway	24
Combination Fraction	1.20	Montana Tonopah	90
Daisy	71	Nevada Hills	1.50
Fairview Eagle	25	Rawhide Queen	45
Florence	4.45	Sandstorm	20
Gold Bar (Bullfrog)	1	Silver Pick	10
Goldfield Con	8.20	St. Ives	20
Gold Kewenas	20	Tonopah Extension	49
Great Bend	19	Tonopah of Nevada	6.50
Jim Butler	17	Tramp Con	9
Jumbo Extension	19	West End	35

(By courtesy of W. C. Ralston, 353 Bush St.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Jan. 14.	Jan. 21.
Amalgamated Copper	80¼	79
American Smelting & Refining Co	84⅝	87⅛
Boston Copper	15⅛	14⅝
Butte Coalition	25½	24
Cumberland Ely	8⅞	8⅜
Dolores	6⅞	7
El Rayo	3¾	3⅜
Giroux	8½	8⅞
Greene-Cananea	11½	11½
Indiana Sonora	4¾	4¾
La Rose	6½	6½
Miami Copper	14	13⅞
Nevada Consolidated	19¼	18½
Newhouse	5¼	5¼
Nipissing	9¾	10⅛
Ohio Copper	6¾	5¾
Tennessee Copper	44	44½
Utah Copper	45¼	44¼
Yukon	4⅜	4⅜

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. January 21.		Closing prices. January 21.
Adventure	8½	Michigan	12½
Ahmeek	155	Mohawk	65
Allouez	35	Nevada Con	18½
Amalgamated	79	North Butte	79
Arcadian	3	Old Dominion	54
Atlantic	16⅛	Osceola	130
Boston Con	14¾	Parrot	28¼
Butte Coalition	24¼	Quincy	91
Calumet & Arizona	112	Rhode Island	4¾
Calumet & Hecla	645	Santa Fe	2¼
Centennial	30½	Shannon	16
Copper Range	76¾	Tamarack	78
Daly-West	10	Trinity	15
Franklin	15	United Copper Con	14
Granby	103	Utah Copper	44
Greene-Cananea, ctf	11	Victoria	4½
Helvetia	3¾	Winona	5
Isle Royale	24½	Wolverine	150

General Mining News.

ALASKA.

On Cooper gulch there has recently been found an old river channel which is reported to be both rich and extensive. The finders, A. Jorgenson and R. E. Sutherland, believe this river channel to have been the source of the rich third beach of the Three Star claim.——There is increased activity this year in the Willow Creek district. Some Oklahoma capitalists operating the Gold Quartz Co. have bought a property from Bartholf Bros., on which they have erected a small stamp-mill. Bartholf Bros. expect to open up their Gold Wonder mine in the spring with a 3-stamp mill. McCoy & Thomas, owners of the Gold Bullion mine, have let a contract for running a 100-ft. adit and for the erection of a stamp-mill.——A 10 days' run brought 66 oz. of bullion to the three men operating O. G. Herning's placer mine on Grubstake gulch.——Robert Compton spoke most enthusiastically of the Fairbanks district on his return from Valdez. He has been working No. 5 Below on Little Eldorado creek, and was much encouraged by the discovery of large nuggets, some of which weighed as much as 20 oz. each. He is convinced there are still big things to be found, and instances Goldstream, No. 17, and Engineer creek as rich properties which were passed over by thousands in past years.

ARIZONA.

COCHISE COUNTY.

A short time ago the Calumet & Arizona Co. started development on the Hope and Wagner claims which adjoin the property of the Shattuck Arizona Copper Co. A 2-compartment shaft is being sunk, and will be carried to a depth of perhaps 700 ft. Drifts will be run to explore the ground at the same depth in which the orebodies have been found in the Shattuck on the northwest and Pittsburg & Duluth on the southeast. The copper production of the C. & A. smelter at Douglas for the last two months has been unusually large, approximating 5,000,000 lb. per month. The new 500-ton furnace installed a few months ago has been working splendidly, which accounts for the extra tonnage smelted, while the large body of high-grade oxide ore on the 1300-ft. level of the Hoatson has added materially to the copper production.——The excellent recent ore developments in the Superior & Pittsburg mines have again started rumors of a possible combination of the S. & P. and C. & A. properties, both being at present under the same management.——A considerable increase was recently made in the working force of the Shattuck Arizona Co., and since that date regular shipments of ore have been made to the Copper Queen smelter at Douglas. Since active work has been resumed more high-grade ore has been found on the 600-ft. level, which may be a continuation of the large orebody already developed to a good extent. The regular annual stockholders' meeting of this company will be held in February, when it is believed the final decision will be made upon the erection of a smelter at Douglas.——For several months there has been considerable activity in the Courtland district. Four companies are operating there employing about 250 men. These companies are the Copper Queen, Calumet & Arizona, the Great Western Mining Co., and the Leadville Mining Co. The first three are operating two shafts each, and the ore developed in the entire district is satisfactory. In the Mary shaft of the Great Western Co. good-sized bodies of high-grade oxide-ores have been found.——The Commonwealth mine is running 20 stamps and five rolls. They are hoisting 125 tons out of the B shaft, and quarrying out 70 tons in an open-cut, making 200 tons per day. The big cave of last year was a blessing in disguise, as J. Metcalf, the superintendent, has pulled 40,000 cars out of a single shoot for filling. They are working $3 ore at a fair profit, as the labor sheet shows a cost of 83c. per ton, including hoisting and timbering. About one-third of the tonnage goes direct from the rolls to the cyanide plant.——The Copper Belle is shipping 80 tons of sulphide ore per day to the Shannon smelter, and is piling up an extra supply in case of emergency.

GRAHAM COUNTY.

I. N. Stevens reports that while doing assessment work on the Kentucky claim, owned by Julius Lexinsky, of New York City, a strike of copper glance ore was made. On the property is an adit now in 225 ft., which will be lengthened to 250 ft. before a cross-cut is driven to determine the extent of the copper orebody. The Kentucky claim is near Garfield and not far distant from the property of the Stevens Copper Co.——F. S. Hoyt has so successfully operated the cyanide plant on the tailing of the old Silver King mine for several months past that he is preparing to increase the capacity from 30 to 60 tons per charge.——The Copper Creek Mining Co., under the superintendence of R. Roy Sibley, has made good progress during the last two months. The two-compartment shaft of the American Eagle has been completed to the 200-ft. level, and a station is being cut at this point, which will include pump station and sump. Timbering has been completed, and the shaft started below the 200-ft. level, three-compartment in size. The mill-site is ready for excavation work; nearly all the machinery is on the ground, and the power-plant is fully equipped.



The Start of a New Camp.

GILA COUNTY.

The events of the week in Globe were an important strike of sulphide ore in the Gray mine, the ratification of the contract for the sale of the Inspiration mine to the Gunn-Thompson interest, and the completion of the first payment of $250,000 on the property; and the placing of the order for machinery for the smelter which the Arizona Commercial Copper Co. is to build.——The Inspiration Mining Co., of which William B. Thompson, of New York, and George E. Gunn, of Salt Lake City, now have control, is a promising copper property adjoining the Miami mine on the southwest, and is reported to have over a million and a half tons of sulphide ore blocked out.——A company has been organized to take over the option held by H. B. Hovland on the Live Oak group of claims, about six miles west of Globe. The organizers of the company are Henry B. Hovland, Hoval A. Smith, D. L. Fairchilds, and Walter A. Barrows, and the indications of their development work gives them every hope of success.——There is a movement on foot in Globe to secure for the mines a part of the electric power shortly to be generated at the Roosevelt dam.

MARICOPA COUNTY.

W. W. Wishon expects that the Central Arizona Electric Power Co., of which he is manager, will be ready to deliver power in about 60 days. The plant has been designed and is being erected by the Chicago firm of Evans, Meisse & Co., and will develop 1200 hp., with the probability of the addition of a further 500 hp. in six months. The greater

portion of this power will be used by the Octave Mining Co., the remainder to be sold to irrigation companies and for the lighting of the town of Wickenburg at the rate of $150 per horse-power per annum. Even at that rate it is believed that this will afford a saving of 20 to 40% over the present cost of generating power with fuel oil.

YUMA COUNTY.

A party, under the leadership of George Mitchell, president of the Clara Consolidated G. & S. Mining Co., recently visited their property, situated some 16 miles from Bouse. The company owns 155 claims of copper-bearing land, the development of which has justified their starting to build a smelter to treat 350 tons per day, and they further hope to bring in the railroad to the mines from Bouse. The party contained among others, George A. Treadwell, of New York, George Mitchell, T. Carrigan, T. P. Cullen, and R. E. Morrison.

CALIFORNIA.

ELDORADO COUNTY.

The new slate mill at the Eureka quarries at Slatington has started work recently and is now working on a carload order for an electrical concern in San Francisco. The quality of the product is said to be first class.——It is rumored in the Georgetown district that the Loon Lake Water & Power Co. is about to dispose of its holdings to a company of New York capitalists.——A new 2-stamp mill has been installed at the Independence mine and placed in commission. A 20-hp. gasoline engine furnishes the motive power. The mill was erected by George M. Ure, of Placerville.

SISKIYOU COUNTY.

(Special Correspondence).—The Blue Ledge mine, situated in the Siskiyou mountains, near the headwaters of the Applegate river, has about two miles of development in the shape of adit levels, parallel drifts, winzes, and raises, on a north-south mineralized zone that strikes along a contact of mica-schist with a dark-colored schist. The zone of mineralization is 60 ft. wide in places, extending from the dark schist as a foot-wall into the mica schist. The bulk of the ore is a chalcopyrite, accompanied by gold and silver, resembling in grade and character the Mammoth ore at Kennett. There are nine adit levels running southerly, the longest being 1300 ft., making a depth of 600 ft. between the highest and lowest workings; another adit has been driven northerly from the main base of operations. No stoping has been done, though there are 30,000 tons of ore on the dump as the result of development work alone. F. W. Carnahan, superintendent of the property, considers the ore well adapted to the requirements of a copper smelter, without the addition of ore from an outside source. It is presumed that a smelting plant may be erected before long, though it is understood that no definite steps in that direction have been taken. The Blue Ledge belongs to Robert S. Towne, who is operating mines at Sierra Mojada and Santa Barbara, and a smelter at San Luis Potosí, Mexico. Other properties have been developed to some extent in the Blue Ledge district, the work on them all aggregating about 2000 feet.

Yreka, January 16.

TUOLUMNE COUNTY.

Roger Knox assumed the superintendence of the Black Oak on New Year's Day in place of M. A. Knapp. He is now engaged in unwatering the mine, which has already been accomplished down to the 600-ft. level. Meanwhile the mill is being run from ore from the dumps.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A strike has just been made on the Ajax property, on Leavenworth Mtn., operated by the Big Indian M. Co. The discovery was made in driving the lower adit, a body of smelting ore being uncovered, which is now being placed in condition for stoping. Edward Butts, who is manager, states that shipments will be started during the next few days.——M. J. Riley, leasing on the Sunburst, has started a shipment of 300 tons of 'cobbings.' The west drift from the Grant level has been driven 75 ft. and stoping has been started. There is exposed a streak of smelting ore that is from 6 to 14 in. wide, which assays 204 oz. silver per ton.——A campaign of development has been put under way upon the Paragon group of claims, on Sherman Mtn. An adit has been started which is now in 20 ft. E. W. Shepard, the manager, states that machinery will be installed in the early spring.——A number of lessees holding privileges on the Phillips vein, cut by the Burleigh adit, are to resume operations. Work was suspended about a year ago, at the time the undertaking was put under way. As a diamond-drill is in use, the leasing work will not interfere with the operations being carried on by the Dives-Pelican and the Seven-Thirty M. & M. Co. The block of ground held by Dearstyne & Hancock contains ore of good grade, the streak being from 8 to 20 in. wide, worth $40 to $45 per ton in silver and lead. There is also showing a body of lead-zinc ore that can be mined and milled at a profit. Shipments of the last named product will be made to the custom mills in the lower end of the county.——Barney Barncássie, leasing on the Columbia, Silver Mtn., has started shipments of smelting ore. The product is being sent to the Georgetown sampler and is worth from $35 to $40 per ton in silver and gold. Stoping is in progress and a streak of ore is being followed that is from 6 to 10 in. wide. The property is controlled by W. A. Maxwell, of Georgetown.——Within the next ten days the force of men employed at the Black Eagle mine, on Chicago Mtn., will be increased. J. F. Puchert, the manager, has made a number of improvements, and from this time forward a heavy tonnage of ore will be extracted. This mine has been developed by a shaft sunk to a depth of 585 ft., while drifts have been run at each 75-ft. level. The longest drift is on the sixth level, having been advanced for 310 ft. In the breast there is exposed 10 in. of lead ore that is worth from 1 to 2 oz. gold, and from 30 to 70 oz. silver per ton. The compressor plant recently purchased is now being connected and some time during the next two weeks machine drills will be brought into use. The aerial tramway running to the base of the mountain, 6000 ft. distant, will probably be completed within 30 days, or by the time the new mill is ready to be put into commission. The mill is being equipped with rolls, screens, tables, jigs, in addition to an electro-chemical process. A set of Triplex rolls with a capacity of 100 tons per day has been purchased. This is the first time that this piece of machinery was ever installed in Clear Creek county.——The Choctaw property, on Saxon Mtn., is to be consolidated with the Miller group of claims. The Miller adit will be continued to the Choctaw vein, which produced about $75,000 from a shaft sunk to a depth of 60 ft., with comparatively little driving and stoping. The objective will be reached within 130 ft. The Miller vein is an extension of the Choctaw to the west and some high-grade ore was mined a few years ago from the upper workings.——Driving the west drift of the Ramsdell is in progress, and this week a streak of lead ore was cut that is from 10 to 14 in. wide. Assays indicate 2 oz. gold, 35 oz. silver per ton, and 32% lead. It is understood that a campaign of development is to be carried forward during the present year. G. W. Teagarden is manager.——The Mollie Gibson group of claims on Saxon Mtn. is again undergoing development by Chad. Kline, the owner. The adit is being driven and it is expected to intersect another vein within 30 to 40 feet.

Georgetown, January 16.

GILPIN COUNTY.

It is reported that steps are being taken for the reorganization of the Grand Central Mining Co., formerly known as the East Whiting, on Gunnell hill. The property is equipped with a first-class plant, including an air-compressor.——A boiler plant has been taken to the German mine, operated by the German & Uranium M. Co. The company will install a large hoisting plant and erect a

new shaft house, and they are also interested in the Leontine and Empire mines, farther west on Quartz hill.

SUMMIT COUNTY.

The mill of the Wellington Mines Co. is nearing completion. The crusher and rolls have been installed, the jigs are being built, the tables are about ready, and every line of work is proceeding at a satisfactory rate. An adit to connect the mill with the Oro workings lacks only a hundred feet of completion, and both should be ready about the same time.

TELLER COUNTY.

James McIlwee, the superintendent of the Roosevelt drainage tunnel, is employing a selected gang of men to drive their heading at a maximum rate. When working with two shifts, an advance of 113 ft. was made in the first seven days of the present month. They have been using a pair of the No. 6 Water Leyner drills, which make from 24 to 30 holes per day; and to effectively break this hard Pike's Peak granite they charge their holes with either an 80% dynamite, or with 100% powder, containing 92% nitroglycerine and 8% guncotton, made by the Dupont Powder Co., of New Jersey. Taking into consideration the fact that the heading has an area of about 70 sq. ft., McIlwee is in hopes of making a new monthly world's record.

IDAHO.

BOISE COUNTY.

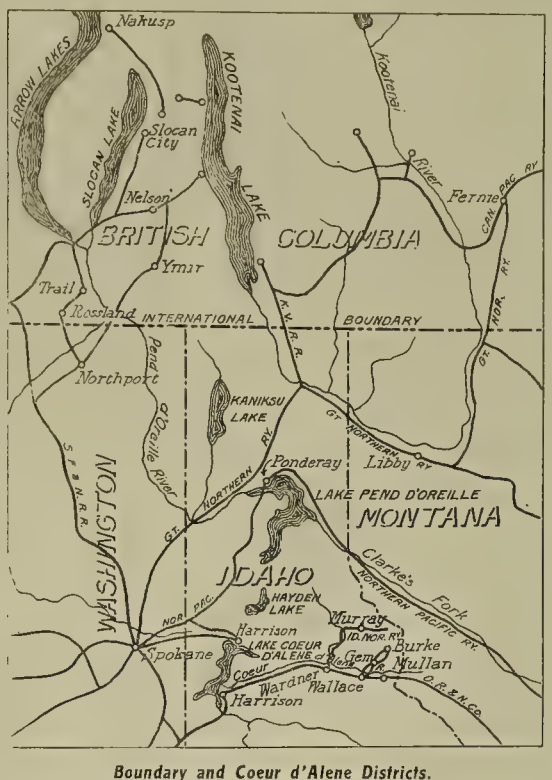
The Gold Hill mine, which has been one of the most productive gold mines in this district, is letting leases on its upper workings. This property has been in litigation for several years, but has recently been purchased, and is now consolidated with the Iowa Mines, as the Gold Hill & Iowa Mines Co., with E. E. Carter as manager. It is the intention to lease all the workings above the water-level and to make suitable arrangements with these lessees to treat their ores in the Iowa mill.

IDAHO COUNTY.

Idaho Central Mining Co., of Spokane, which has been developing the Alberta mine in the Elk City district under a bond, has made the last payment to Marsh Bros., and taken full control of the property. The group consists of five claims, 12 miles southeast of Elk City. The Alberta is one of several groups of properties that lie adjacent to each other, which were taken under bond recently by J. B. Weimer, of Salt Lake City. On the Alberta the main working shaft is being sunk on the foot-wall side of the vein. Cross-cuts will be driven and levels opened up every 100 ft. The company will endeavor to get the shaft down 300 ft. by June 1, and will soon install a hoisting plant of 1000 ft. capacity. Accommodations for 25 men, and also a wagon-road have been constructed. A. W. Boyd is manager of the property.——C. E. Svenson has sold his Golden Scale placer ground, two miles from Elk City, to P. J. Jennings, of Portland. The placer is an old river channel with a maximum depth of 70 ft. to bedrock.

SHOSHONE COUNTY.

(Special Correspondence).—Work is about to be resumed on the property of the North Franklin Mining Co., operating a group of claims adjoining the Star and the Morning mines in the Mullan district. The annual meeting of stockholders was held at Wallace at the beginning of the week and the officers elected for the ensuing year. The property will be managed by Norman Ebbley. It was decided at a later meeting of directors to levy an assessment of five mills per share.——According to a statement issued by the Reindeer Copper & Gold Mining & Milling Co., $25,000 was spent during the past year on development. The treasury is depleted at the present time, but an assessment of five mills per share has been levied by the directorate. Throughout the year development has been confined mainly to the driving of a 2800-ft. adit designed to give a depth of 1000 ft. This adit has now been driven about 2062 ft. The property is fully equipped with machinery and has a good showing in the upper workings. ——Work has begun on the Copperhead mine in the Lookout district, and it is expected that a sample car of ore will be shipped to the smelter in the near future. The old adit, which had been driven a distance of about 300 ft., has been abandoned and another started to cut the main lead at great depth. The ore carries lead, silver, and copper.——All arrangements have now been practically completed for the erection of the new smelter in the North Fork district. A site has been secured and it is the intention of the company to erect a plant of 100 tons capacity to handle the copper ores of the north side. Contracts have been made with the Handspike and the Horst-Powell mines, according to the terms of which the smelter is to be running by October 1 of this year. Maurice Blanchard, whose patents will be operated in the new plant, states that it is the intention to commence active work on the erection of the plant as soon as the snow clears in May. In addition to the contracts referred to Mr. Blanchard states that enough ore has been promised to keep the plant busy all the time. If the new process proves a success it is the intention to erect other plants for the treatment of both lead and zinc ores.——The Ambergris Mining Co. has increased its capitalization from $1,500,000 to $3,000,000. The property recently became involved in litigation with the adjoining Hercules mine, but all claims were adjusted out of court. By the terms of the settlement the property will be developed through the workings of the Hercules mine, the owners of which will expend about $75,000 on the Ambergris property.——A circular has been issued by the trustees of the Lucky Calumet property warning stockholders not to part with their stock to firms of Eastern stockbrokers who are advertising for the stock and offering the highest market prices. It is believed that some Eastern syndicate is attempting to secure control of the property and that 200,000 shares have already passed into their hands.——Arrangements have been made by the Pittsburg Lead Mining Co., which has just resumed work, by the terms of which each stockholder will advance money to the company in the ratio of five cents for every share of stock held. In this way sufficient funds have been raised for the continuation of work all winter. The financial statement issued by the company shows that there is at present $1453 on hand,



Boundary and Coeur d'Alene Districts.

and stock valued at $62,746 still remains in the treasury. The mines and real estate is valued at $795,805. The equipment is valued at $52,864, while $179,930 was spent on development, making a total for the assets and equipment of $1,092,799. The company's liabilities are said to consist of a total of $955,692, leaving a surplus of $137,106. ——It is generally believed throughout the Coeur d'Alene that the Federal Mining & Smelting Co. has secured control of the Star mine in the Mullan district for a consideration said to be in the neighborhood of $1,000,000. The property of the Star company consists of a large number of patented claims adjoining the Morning mine of the Federal company in the Mullan district. The principal owners of the Star company are John A. Finch, A. B. Campbell, I. N. Payton, and Austin Corbin, of Spokane, and Henry Wick, of Youngstown, Ohio. If it is actually the case that the Federal company has purchased this property the mine will probably be developed through the workings of the Morning mine and the ore treated in the Morning mill.

Wallace, January 19.

MICHIGAN.

Isle Royale has temporarily stopped sinking its Baltic lode shaft while concreting the collar. The shaft is bottomed in the formation. Hoisting engines at both No. 4 and 6 shafts are in place and ready for duty. The company is now engaged in installing the compressors. These shafts are slowly increasing their output until now they are shipping 10 cars per day. All the heads at the stamp-mill have undergone a re-construction until now there are three compound heads in operation.——The 650-ft. level has been reached in the Ojibway No. 2 shaft and cross-cutting to the lode is now under way. The levels above have shown the characteristic Kearsarge formation of a rich character, hence no driving or stoping will be done until the desired depth is attained.——Osceola will show in its annual report an increase in production over last year. Nearly 24,000,000 lb. will be produced this year at a considerable profit. With its small capitalization of 96,000 shares, every cent of rise in the metal market is equivalent to $2 per share to the company. It is expected that in March the new No. 4 North Kearsarge shaft will be making regular shipments to the mill. With the addition of this producer the capacity of the mill will be reached, and it is not at all unlikely that the company will be making provision to increase the milling facilities to take care of the increased tonnage. The North Kearsarge possesses the outcrop of the Kearsarge lode for a distance of 6500 ft. Drifts south from the 37th level of No. 3 shaft will undermine the Wolverine, intercepting the rich ore common to that property. No. 4 shaft adjoins the Ahmeek and drifts from this property and Allouez have cut their richest ore on the Osceola boundary. Drifts from No. 3 shaft to the north have found the richest ground in No. 4's territory. Hence it is safe to assume that No. 4 will have an unusually rich field to work in.——Owing to trouble in sinking its sand-pipe North Lake has not as yet begun drilling. A distance of about 400 ft. has been traversed without striking the lode.——In an endeavor to find the lodes of the Lake and Adventure properties to the north, Elm River is making preparations to cross-cut the formation at the 200-ft. level. In the course of sinking this opening an unknown lode was intercepted, but as yet no exploring has been carried on to prove its value.——A statement has been given out by officers of the Superior company to the effect that the mill-test at that property showed an average of 36 lb. copper per ton for the first day's stamping. This is considered remarkable for the Baltic lode. The average yield from this formation has heretofore kept well in the neighborhood of 20 lb. per ton. It is not expected that the Superior's showing will continue at its present richness, still it has a wide range of fluctuation before the average is reached. Superior's success is notable also as the first outside property in which the Calumet & Hecla has interested itself. It will also serve as a stimulant to further exertions on the part of other mines on the north side of Portage lake who have been undertaking considerable exploration in hopes of finding the Baltic on their property.——Quincy will show an increase of production in 1908 as compared with 1907. During the latter year 17,796,000 lb. were mined, while it is expected 20,500,000 lb. will have been produced this past year. Last year the company's costs were 11.2c. exclusive of construction, and 12.2c. including that item. Quincy's construction costs will be heavy this year as a result of the expense incurred in sinking the new Pontiac shaft on the Arcadian lands and the construction of the No. 2 steel shaft-house. No. 2 is the company's oldest shaft and produces about 25% of the total product.——The announcement that the option of Copper Range on the Globe tract would be relinquished on February 1 was not unexpected. The vein has made a poor showing ever since development work started. The lowest level has about 500 ft. of drifts, disclosing lode poorly mineralized. Work was commenced in the spring of 1905 and approximately $500,000 has been expended for exploration. The first shaft had to be abandoned because of quicksand, and the present shaft, 1040 ft. deep, was begun in October of the same year.——What is believed to be the Baltic lode was found several hundred feet farther west than was expected in the fifteenth level of the Atlantic's section 16 shaft. The cross-cut passed through 20 ft. of ore before reaching the hanging wall, and of this about three-quarters is well mineralized. They have started driving in both directions, and are also sinking the shaft below the twentieth level.——The Winona discontinued rock shipments in November 1907, at the time of the break in the price of copper. It is proposed to resume shipments this spring. Meanwhile the directors have had to assess the shareholders for $2 per share, and will shortly take action calling another assessment, which will probably amount to $1 per share. The need of these additional funds is due to the extensive development work carried on during the past year, and the fact that less than 13 lb. copper was obtained from the ore extracted.

NEVADA.

ESMERALDA COUNTY.

The new Truitt-Rankin mill at Schurz is now in operation and treating ore from the camps of Granite and Rawhide. The mill is equipped with 10 stamps, amalgamating plates, two California concentrating-tables, and four cyanide vats, each having a capacity of 400 tons. Water is secured from the Walker river and steam power is used.

NYE COUNTY.

It is hoped that the early part of February will see the completion of the custom mill, which L. L. and S. Smith are erecting at Beatty. It is close to the Las Vegas & Tonopah and Tonopah & Tidewater railroads, with which it is connected by short spur tracks. All the equipment is on the ground and the corrugated-iron mill building has been ready some weeks. After coarse crushing the ore will be fed to two batteries of five 1000-lb. stamps, and extraction will be effected by amalgamation and the cyanide process. For this all the machinery has been supplied by Hendrie & Bolthoff, of Denver, and will be run by electricity from the line of the Nevada California Power Co. The Smith brothers have developed their own water supply, which will be ample to supply all requirements for treating 40 tons per day.——Two hundred tons of ore have been obtained by Charles Newton, ore purchaser for the Springdale custom mill. This ore will be used to test the machinery before it is opened to general use on February 1. ——It is reported that L. P. McGarry and G. S. Johnson, of Goldfield, are considering plans for the construction of a mill for the Bullfrog West Extension Co. The plant will be designed for a capacity of about 50 tons per day.——The output of the Tonopah mines for the week ending January 16 totaled 5173 tons, of an estimated value of $129,300.

LANDER COUNTY.

The consolidation of 154 different mining claims by W. W. Wishon into the Austin-Manhattan Consolidated Mining Co., is the forerunner of much expenditure for mine de-

velopment and equipment. They already have many shafts, a long adit, and several cross-cuts, and mean to install a modern stamp-mill for the treatment of their $10 and $15 ore. D. C. Boley is manager of the present mill, and Marvin W. Ditto is consulting engineer.

LINCOLN COUNTY.

Owen A. Baily, president of the Pioche Demijohn Mining Co., has called a meeting of the directors to take action on the matter of providing better mine equipment. The horse-whim is to be replaced by a gasoline engine and hoist; it is also the intention to install a compressor in order to substitute machine-drilling for hand work.

LYON COUNTY.

A combine of three of the big leasing companies of Granite has been made and J. H. Boney, of Los Angeles, has become interested. He will assume the management of the combined interests and procure a hoist, to sink the Graham shaft to a depth of 500 feet.

WHITE PINE COUNTY.

In order to finance an extension of the Steptoe smelter and mill the Nevada Consolidated Co. has sold to a Boston syndicate the remainder of the 125,000 treasury shares of the Cumberland Ely, at a price not far from the present market price.——There is some indication of the high regard in which mining property is held in the Ely district, as demonstrated by the fact that over 200 final receipts for patents on claims were secured during the year. At the present time all groups of any considerable size between the McDonald Ely on the east and the Boston Ely on the west, a distance of 8 miles, have been patented.

SOUTH DAKOTA.

CUSTER COUNTY.

(Special Correspondence).—The mining outlook in the southern Black Hills at present is encouraging, and although the recent cold wave (20° below) has temporarily restricted prospecting and mine development, yet there is promise of a fair output of precious metal during the coming season. The circumstances surrounding the mines in the southern Black Hills are somewhat peculiar. The veins for the most part are in the Archean micaceous slate between intrusive granite. The schistosity runs northwest and these belts of veins run with the formation. These quartz veins are inclusive generally at an angle of 60 to 70° from the horizontal. The veins are sometimes in contact with the granite, but sometimes both walls are slate. These 'formation veins' (as they are locally called) are generally low-grade, and usually assay from $2 to $7 gold per ton. They are from 6 to 40 ft. wide, and in the larger ones the ore often consists of alternating quartz and slate, with iron oxide. There is also another class of veins running northeast cutting the slates nearly at right angles. These are nearly perpendicular, and are usually from 1 to 5 ft. wide. They would be classed as high-grade, as the ore will yield from $5 to $500 per ton in gold. There is no silver, copper, or lead worth mentioning in this district, although there is scarcely a mine entirely free from one or the other of these minerals. The veins are all free-milling at the surface and in some cases the free gold persists to quite a depth, but usually becomes more and more base as depth is attained, when it will not amalgamate and the gold ceases to be amenable to the free-milling process, and the cyanide process is required. The Saginaw is the leading mine in the district, with a capacity of 50 tons per day, fully equipped for cyaniding. The mill has 22 vats with Wilfley concentrators and slime-tables. The last clean-up showed an average of $41 per ton in gold. These veins are each from 3 to 4 ft. wide, and the company is on the high-road to prosperity. I. W. Herber is manager.

The Ruberta Mining Co., owning a property situated 4 miles west from Custer, is now equipped with 10 stamps and vats for cyaniding. The plant will be operated on ore from the Ruberta (formerly the Old Charley group of claims) and it is announced by W. W. Olds, the superintendent, that they will start the mill about March 1. The main vein is well developed and ready to supply ore for a steady and continuous run. The Clara Belle, situated about 9 miles north of Custer, an excellent producer of the precious metal in the past, is now idle on account of the caving of the old works. The company forsook the old incline and sunk a new vertical shaft to intercept the vein on its dip, but never found it. The property was recently sold by the receiver and was purchased by some of the largest stockholders for $28,000. They have formed a new company, which will commence cross-cutting to find the vein. The orebody was never continuous, but consisted of large irregular lenses. H. Dole is in charge of the mine.

The Ivanhoe, situated about 8 miles northeast from Custer, also produced high-grade gold ore. It is idle at present and will probably remain so until spring. Herman Ratte, the manager, has gone to Pierre to attend to his duties as State Senator. The mine is equipped with a 5-stamp mill, for testing purposes, and a Chilean mill of 50-ton capacity, but as the ore is hard quartz, it has been found that it will crush only about half that much. The Westinghouse Electric Mfg. Co. is running with full force on its mica mines about 6 miles west of this place, where they employ 100 workmen in the mines and in the splitting and trimming departments. They own the New York and the White Spar mica mines, and several others only partly prospected. They are building a store at the mine, enlarging their boarding-house, and erecting cottages for the accommodation of the workmen and their families. A large vein of fine mica exists in the New York, and another in the White Spar. John Pyne is manager. The Amblygonite mines near Custer are not producing at present, the company mining that material having transferred its activities to Keystone, about 16 miles northeast. The reason given for the removal is that the mines at Keystone are richer and yield about 8% lithia phosphate. The material is shipped to Omaha, where it is prepared for use. The factory in Omaha is in charge of Herman Reinbold. Edward Davis has charge at the mines, the post-office address being Custer.

Custer, January 15.

CANADA.

BRITISH COLUMBIA.

The precise figures of the mineral production in the Province of British Columbia for the 12 months of 1908 are not yet complete upon the Government records. E. Jacobs, of Victoria, B. C., has, however, made a conservative estimate of the production from data on hand, which is as follows:

Gold, placer, 34,000 oz	$682,000
Gold, lode, 256,000 oz	5,291,520
Silver, 3,637,000 oz	1,518,500
Lead, 34,775,000 lb	1,654,695
Zinc and iron, 10,000 tons	280,000
Copper, 43,885,000 lb	5,792,820
Total	$15,219,535
Coal, 1,700,000 long tons	5,950,000
Coke, 248,000 long tons	1,488,000
Building material, etc	1,200,000
Total	$23,857,535

The total for the year ending December 31, 1907, was $25,882,560, so that the production for 1908 shows a decrease of $2,025,025, the shrinkage occurring in the production of lead and copper.——The activity displayed at Flathead in boring for oil during the past fall and summer has had to be suspended owing to the heavy snowfall and intense cold.——It is expected that the Sullivan Group Mining Co. will be re-formed at the next meeting of the shareholders, and operations at the mine and smelter resumed at an early date.——The Molly Gibson, in the Burnt Basin, owned by C. Schwartzenhayer and others, recently shipped a carload of 28 tons to the Trail smelter, which netted the gratifying return of $20 per ton.

Special Correspondence.

TORONTO, CANADA.

Output of Cobalt. — Concentration of Ore. — Sale of the O'Brien.— The Crown Reserve.—Gowganda District.

The output of Cobalt sent to the smelters during the year just closed amounted to a total of 25,463 tons, as against 14,851 tons in 1907. These figures do not adequately represent the increase in silver production, as during the year the Buffalo and Coniagas mines installed concentrators. Cobalt Central is now concentrating on a large scale, and the McKinley-Darragh will shortly have a concentrating mill in operation. Several other mines are also disposing of their low-grade ores to custom concentrators on the ground. But for the low price of silver the output would have been considerably larger, as many of the mines have pursued a conservative policy in restricting the immediate output. The list of shipping mines, 32 in number, is headed by the La Rose with 4715 tons, the second place being taken by the Nipissing, which shipped 3557 tons, the O'Brien coming third with 3428. There have been frequent reports as to negotiations for the sale of the O'Brien to a syndicate, and a few days ago the statement was widely circulated that the deal had finally been closed for $8,000,000. This is authoritatively denied, and it is further stated that no negotiations for the sale of the mine have taken place.

The new plant of the Temiskaming will be in operation in the course of a week or so. The compressor has a capacity for operating 20 drills. A new dynamo is being installed. The new shaft sunk for the purpose of a main haulage-way is down 150 ft. and will be continued to the 300-ft. level. The mill at the ore-house of the Crown Reserve, comprising a No. 2 Austin crusher with attachments, is running satisfactorily, treating 50 tons of ore per day. The shaft in open-cut No. 1 is down 125 ft. and the vein is found to maintain its width and quality. The north cross-cut from No. 1 shaft has cut several small veins showing silver contents. No. 1 shaft of the Chambers-Ferland is being deepened. At 120 ft. the vein, averaging 5 in. a short distance below the surface, has widened to 18 in. high-grade ore, showing native silver. In the west cross-cut from No. 2 shaft at a distance of 219 ft. low-grade ore 8 ft. wide was encountered, showing calcite, niccolite, and galena. At the Silver Queen extensive development work is being carried on, some 3500 ft. of driving and cross-cutting having been done on the 75 and 150-ft. levels of the main workings. To the south a new shaft is down 75 ft. A sump of a few feet depth will be sunk, a station cut, and underground development undertaken on several promising veins. On the Little Nipissing lease on Peterson lake the shaft is down 150 ft., at which level a cross-cut is being driven to pick up the main vein, along which driving will be carried 50 ft. to strike a rich cross-vein. At the Rochester a great deal of trouble has been occasioned by water, which has delayed the sinking of the main shaft, now down 170 ft. The difficulty has been handled effectively, and good headway is now being made. A good find has been made at the Pan Silver mine in the Temiskaming section of the camp. In the cross-cut at the 100-ft. level a vein was tapped 8 in. wide and assaying about 2000 oz. per ton. At the Otisse mine, in the Montreal River area, a vein which appeared lean on the surface widened at 30 ft. to from 12 to 18 in. and is yielding high-grade ore. A carload of ore has been sacked ready for shipment. On the Clinton location, adjoining the Otisse, a rich vein running from 6 to 11 in. wide has been found. Control of the Kerr Lake mine has been acquired by Adolph Lewisohn of New York. S. S. Rosentamm, Mr. Lewisohn's representative, accompanied by Benjamin B. Lawrence, consulting engineer to the Kerr Lake, inspected the mine this week.

Prospectors and others are pushing forward into the Gowganda district, notwithstanding the hardships entailed by the lack of accommodation. The Canadian Northern Railway Co. is rapidly pushing the construction of the wagon-road from the end of steel at Sellwood, to Gowganda, a distance of some 50 miles. A force of 60 men and 20 teams is at work and the contractor announces that the work will be finished by the 15th of this month. The Canadian Northern will accept freight from any point in Canada for delivery in Gowganda. It will be forwarded by way of Sudbury to Sellwood, and thence by the company's freight teams to its destination. This undertaking will make Sudbury, rather than Elk City, the base of supplies for the new camp. An expedition will set out this month from Elk City, in charge of Thomas Saville, a noted guide and prospector, who has lived for years with the Indians, in search of a new silver field lying to the west of Gowganda, the existence of which Saville claims to have learned from the Indians. The party will travel with Indian dog-teams.

Reginald W. Brock, formerly a professor in Queen's University, Kingston, who has for some time been connected with the Canadian Geological Survey, has received the appointment of Director of the Survey. He had been acting in that capacity for some time.

MEXICO.

Financial Condition of Republic.—Railroad Earnings. — Oil War. — Mining Law.—El Tajo Mill.

The report of Mexico's Finance Minister, José Y. Limantour, for the fiscal year 1907-08, which has just been made public, is certainly very encouraging to all interested in the welfare of the Republic, for the figures show a total revenue of ₱111,771,867, with disbursements of ₱93,177,441, leaving a surplus of ₱18,594,426. Considering the stringency which has been felt all over the world, and particularly in the United States, during the last nine months of the past year, the results have really been remarkable, for in the history of the Republic this revenue has been exceeded only in the preceding year, and then by but two and a half millions. The years 1905-06 and 1906-07 were the only ones that have shown a larger surplus than that of 1908. It is true that the financial difficulties that came upon the United States were not so severely felt in Mexico until toward the close of the fiscal year, and it is possible that the current year may not show up as well; but, viewed from all points, it is a most encouraging report, and clearly shows that as long as the present régime continues, Mexico's financial condition will be sound and its progress may be considered certain.

Like good results have been shown in other quarters. Attention has been previously called to the large returns continuously made by Guanajuato, El Oro, Pachuca, Chihuahua, and many of the large individual mining properties, and now the Government figures reveal that the combined annual surplus of the National railroad and the Mexican Central has been ₱1,003,638 over the fixed charges of the entire merged system during the transition period pending the complete transfer to the new corporation. The natural economy following a complete consolidation should greatly increase this annual surplus. Forty-eight per cent of the freight carried on these roads consists of the products of the mines and of mine-supplies. On this freight it is claimed that no profit is made. The opening of the Manzanillo branch of the Mexican Central through to the West Coast on December 12 was a notable event.

The oil war, between S. Pearson & Son and the Waters-Pierce Oil Co., which was threatened for March or April, and postponed from month to month, does not seem to have broken loose. It is true that the Pearsons have completed their Minatitlán refinery; that the Waters-Pierce Oil Co. has added, or is adding, several million pesos in improvements to its refinery at Tampico, and is acquiring lands in the States of Vera Cruz, Tamaulipas, and San Luis Potosí; and that the Pearsons are establishing agencies in the various important cities throughout the Republic; but it does not appear that there will be any ruinous cut-throat war; it undoubtedly resolved itself into a friendly or understood competition, with a slight reduction in price to encourage a demand and create a market sufficient for both companies.

The Pearson engineers are understood to be making a six months' reconnoisance examination from San Cristóbal, Vera Cruz, across the States of Chiapas and Tabasco to Frontera, on the Gulf coast of Tabasco, near the Campeche line; and rumor has it that a new element has entered into the oil situation in Mexico in the form of E. H. Harriman, who is said to have Ben Andrews, formerly with the Pearsons, making examinations and acquiring lands in various parts of the Mexican oilfields for fuel oil, in connection with his Southern Pacific railroad. The Mexican Petroleum Co., controlled by E. L. Doheny, is figuring on a pipe-line from Vera Cruz to Mexico City, there to make gas from the crude oil and to use the residue for street paving, but as that means heavy lines and pumps, because of the necessity of running the line to an elevation of over 10,000 ft., there is great doubt as to its economic feasibility, as well as to whether the demand is sufficient to warrant such an outlay.

The proposed new mining law, which caused so much comment at home and abroad, and from which the objectionable anti-foreign measures (particularly the famous Article 144) were eliminated, came up before the Mexican Congress on December 11, and though it had many supporters, it also developed stronger opposition than was expected, the main points being that this was not the right time to change the existing law of 1892, and that as the country had prospered in a manner previously unknown under the present law, it were better to leave well enough alone; the final outcome was that the new draft was laid over to come up before the session of April, 1909.



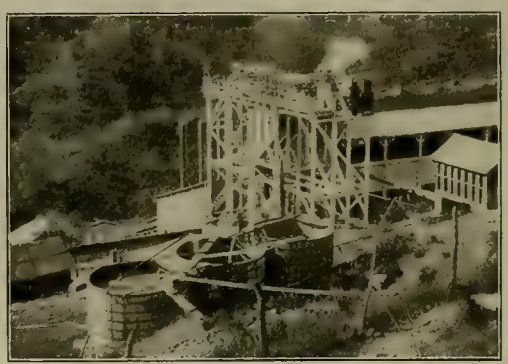
Amparo Mill, Jalisco.

In a recent letter it was stated by error that certain improvements were to be made in the mill of the Ayutla Mining Co., which should have been credited to the Tajo, owned by Makeever Bros., at El Tajo, near San Sebastian; the structure of the new mill is ready for the machinery, which is to consist of 10 stamps, concentrators, tube-mill, and cyanide tanks.

JALISCO, MEXICO.

Amparo Mine.—Milling Process.—El Favor.—Casados Mine.

The Amparo Mining Co. has 2000 acres of land in one block, lying south from Etzatlán, the mine being 10 miles from that town. There is a series of veins striking nearly north and south, through a basalt country; they cut through a mountain spur, the two sides of which slope to a deep arroyo on either side. The working shaft is near the crest of the ridge, the mill being in the south arroyo, with the air-compressor and the old adit on the opposite slope. The general offices are on the north side, from which place a good wagon-road leads to the main shaft. A Roebling aerial tramway, about a mile long, carries the ore from the mine to the mill, making a descent of 450 ft. The hills are well covered by a young growth of oak trees, adding to the attractiveness of the surroundings; some eucalyptus trees have also been planted on the tract. The company employs about 800 men—350 in the mine, 150 about the mill, and 300 as freighters, wood-chopeprs, and ranchers. The mine was operated 75 years by Mexicans before it was sold to the Amparo company, during which time the richer pay-streak was mined, but alongside was always left a good body of what now constitutes milling ore. The former operators entered the mine through an adit driven on the vein. The new company greatly extended the workings from this adit. The adit follows the vein 800 ft., at which point the vein divides; here the work continued 1000 ft. on the east and 2000 ft. on the west branch. The west vein carries the better grade of ore. At 1000 ft. from the point of divergence a fault occurs, the displacement throwing the west vein about 18 ft. westward. Beyond the fault-plane the vein retains its vertical position; and here a remarkable body of ore was opened that is said to measure 600 ft. long, 250 ft. high, and from 3 to 14 ft. wide. The west vein on the south side of the fault is 40 ft. wide in places. Important work has been done on the east vein south of the fault. The main shaft has three compartments and is 750 ft. deep, connecting with the main adit-levels at 500 ft. A winze has been sunk 400 ft. from the adit, and a drift has been run from the bottom of the winze to a point under the shaft. The latter will be sunk to connect with it. This gives a vertical depth of 900 ft. James H. Howard, general manager for the company, states that a sufficient tonnage of ore is in reserve to keep the mill in operation 10 years; and that the property is paying a net profit of



Tramway Terminal, Amparo Mine.

$30,000 per month. Besides the ore blocked out there is a dump of 40,000 tons claimed to assay 450 gm. silver and 11 gm. gold per ton, available for milling. The mill, under the superintendence of William Howard, formerly of El Oro, has 50 stamps, each weighing 1050 lb., dropping 6½ in., 108 drops per minute, crushing 3½ tons per stamp per 24 hr., through 30-mesh screens. The pulp from the batteries is classified by hydraulic classifiers, the fine passing to Johnson vanners and the sand to Wilfley tables. The concentrate made by the tables is re-concentrated by a table specially regulated for this work. The table-tailing goes to sand-collecting tanks, and the vanner-tailing to slime-settlers made of cement. The sand from the collectors passes to sand-treatment vats where a 0.3% cyanide solution is applied. This is followed by a wash every 2 hr. for 5 days, a solution of the same strength being used. Then follow 2-hr. washes for 3 days, with a solution of 0.1% KCy. In the first series of washes lead acetate is applied. The slime is treated in tanks, having Butters mechanical agitators. These are charged with one-third slime and two-thirds solution, the latter having a strength of 0.15% KCy, lead-acetate being added also. After agitating 6 hr. mechanically, and 3 hr. by centrifugal pumps, the slime is settled and the solution decanted. Three more washes follow, 0.1% solution being applied. Each charge in the slime-tank gets 27 hr. mechanical agitation, and 9 hr. aeration by centrifugal pumps. This method will be modified later by the use of Burt filters. The precipitation takes place in zinc-boxes of the usual style.

An analysis of the ore shows the following constituents: Gold per ton, 10 gm.; silver, 450 gm.; lead, 0.3%; iron, 2.9; copper, 0.1; zinc, 0.7; sulphur, 0.5; manganese, 0.9; calcium, 8.5; silica, 74.2; alumina, 1.2. The concentrate sold contains 11.9% iron, 3.4 lime, 9 zinc, 12 sulphur, 9.6 lead, 34.6 insoluble, 464 gm. gold, and 9229 gm. silver per ton.

In the total gold recovery, 35.97% is in the concentrate, and 61.3% in the precipitate; of silver, 18.9% is obtained in the concentrate, and 68.1% in the precipitate. The total extraction represents 97.7% of the gold and 87 of the silver, as shown by the assay values. C. W. Lininger, who took the superintendency of the mine several months ago, states that mining costs are gradually being reduced; for one month recently the cost was ₱3.41 per ton of ore mined. This, it is explained, included little, if any, development work. It is announced that the property will have electric power connections in the next few months, and will then be equipped to use it.

El Favor mine, in the Hostotipaquillo district, 40 miles northwest from Etzatlán, is controlled by Makeever Bros. and their associates, with D. M. Munro as manager. In the holdings are 180 pertenencias, having one principal vein, and several minor veins, in rhyolite. The vein consists of quartz and altered rhyolite, averaging 700 gm. silver and 3 gm. gold per ton. The silver occurs mainly as sulphide, with some chloride and bromide. The ore also carries 11 to 12% iron sulphide, with some manganese. The mine is opened by a series of cross-cuts to the vein; a 1200-ft. adit, now 800 ft. long, is being driven, which will cut the ore 600 ft. below the surface and 400 ft. below the present workings. In all, there are 5000 ft. of development. Equipment for a 20-stamp mill is being installed. It will include Wilfley tables, vanners, two tube-mills, Pachuca agitating vats, and other cyaniding equipment. The Casados mine, in the same district, is one of the old Spanish properties that was operated profitably during an early period. In 1907 W. R. Ramsdell and associates took it over and unwatered it, finding the great body of ore indicated by reports of former operators. After installing hoisting machinery a shaft was sunk to a depth of 200 ft., and from it the vein was opened, showing ore that assayed 700 to 1500 gm. silver and 4 to 12 gm. gold per ton. One cross-cut revealed an orebody 15 ft. wide. Plans for a mill are being considered. The work is under direction of T. N. Stanton.

C. D. Dubois and M. E. Schaef, of the Copper Range Co., expect to install a 60-ton copper-matting furnace at their mine, 40 miles from Navidad bay, where they have copper ore, carrying silver and lead. Their equipment is said to be at Guaymas.

JOHANNESBURG, TRANSVAAL.

Classification for Tube-Milling. — Crown Mines. — Cyanide Tailing for Mine Filling. — Labor in 1908. — Rand Statistics. — One Million Sterling Profit from One Mill.

Significant experiments, on a working scale, have recently been made at the Simmer & Jack Proprietary in connection with the classification of tailing pulp for tube-milling. The work has been carried on under the direction of W. A. Caldecott and G. O. Smart, and the results were described by the former at the last meeting of the South African Association of Engineers (a body now gaining in vitality by the broadening of its sphere of activity). Briefly stated, the scheme is to install, instead of the usual spitzlutte and de-waterer, a single conical classifier, yielding, through a large underflow opening (2⅝ in. diam.), a coarse sand product for tube-milling and a peripheral overflow suitable for the sand and slime-plant. A special feature of the conical classifier consists of an internal, notched horizontal disc diaphragm near the bottom, by means of which it is possible to insure a steady underflow of thick pulp, with less than 30% moisture, requiring to be thinned down for the tube-mill feed. One of these classifiers, 6 ft. diam. and 9 ft. deep, has been yielding an underflow of 440 tons (solids) of which 65% remained on a 60-mesh screen (0.01 in.), and an overflow (for the cyanide works) containing 10% coarser than 60-mesh. This could be reduced if the mill requirements were not so heavy. One advantage claimed is the lessened elevation of pulp for the tube-mill circuit; beyond the height necessary to serve the tube-mills, only the final pump being elevated to the classifiers for the cyanide works. Other advantages are economy in initial cost; simplicity of operation; dispensing with a supply of mill-water and its pumping-cost; and freedom from liability to derangement by choking, owing to the large size of the underflow outlet.

The basis of the great West Central Rand mine consolidation, for some time foreshadowed, was officially proposed by S. Evans at the meeting of the Crown Reef last week. The new combination, to be named the Crown Mines, will constitute the most productive and profitable gold producing company in the world. It will include the Crown Reef, Crown Deep, Langlaagte Deep, Robinson Central Deep, and the inactive Paarl Central. The Crown Mines, representing an area of 2722 acres of unexhausted reef-bearing ground, and over 5000 acres of freehold ground, will be in a position, if the scheme be carried, to crush 1,800,000 tons of ore per annum. Assuming the yield at 30s., and the costs at 15s., which are justified by present individual performances, the output will approximate £2,700,000, and the profit £1,350,000 per annum. Whatever criticisms may be advanced against other combinations, this merging of interests has in its favor certain factors of relative position that place it above opposition. The chairman, however, made use of the occasion to indicate the advantages of consolidations in general, only lightly touching upon that most apparent in the financial world, namely, the extension of the life of companies approaching exhaustion, and the consequent satisfaction of those shareholders insufficiently acquainted with gold mining conditions to lay aside money from their dividends for the redemption of capital. The principal points of advantage indicated by Mr. Evans were that a company treating large quantities of ore derives more benefit per ton treated from its capital expenditure; that with big tonnages general charges, per ton, are of course reduced to a minimum; that lowered costs enable the great masses of low-grade ore to be treated profitably; that greater concentration of work underground is practicable; and that large organizations can afford to secure the services of the most expert and highly paid men. In this connection, reference was made to the opinions expressed by the Industrial Commission of the United States in 1902 as to the ability of great industrial organizations to secure talent of the highest order.

One of the mines on the Rand, that will soon be extensively re-opening old upper-level workings with a view to extracting low-grade ore from the Main Reef still left in the foot-wall, is arranging for the use of the cyanide tailing as mine-filling. Although tens of millions of tons of this tailing is dumped along the Rand, the material has only been utilized for such a purpose once or twice, many years ago. Its possibilities, however, have often been discussed in view of certain cavings of old ground. In Western Australia, where conditions demand the employment of filter-press tailing in current workings, the Mine Regulations specify that the tailing used shall not contain more cyanide than equivalent to 0.01% KCy, a condition easily obtained by water washing in filters, which is not done on the Rand. It is also stipulated that a strong current of air shall be maintained through any workings which are being filled with such tailing so long as men are working and passing therein. No clause in the Transvaal Regulations refers to the matter, nor will there be any call for legal provisions, as the work is undertaken under the direction of technical men of the highest ability.

Upon reviewing the records for the closing year, it is apparent that the labor position has improved remarkably, and that the ill-effects of Chinese repatriation have been reduced by exceptional increases in the number of Kaffir recruits. Comparisons for January, June, and October stand as follows:

	Whites.	Kaffirs.	Chinese.
January	19,392	153,876	33,849
June	19,985	170,513	19,071
October	20,924	178,367	14,314
Ten months increase	1,532	24,491	19,535 decrease

The net increase in unskilled laborers (excluding the white men now employed as such) is thus about 5000. The ratio of whites to colored workers has remained at approximately 1 to 10.5.

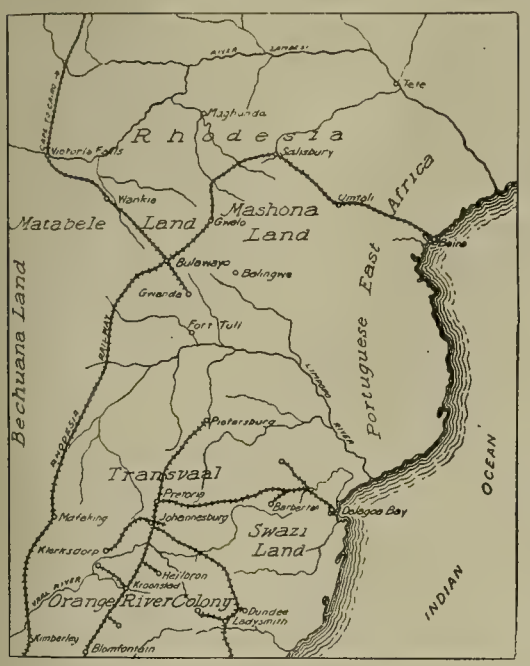
The annual report of the Consolidated Gold Fields of S. A. Ltd. is always of general industrial interest. Indeed, the complaint is sometimes heard that too much attention is devoted to generalities, and too little to matters of special concern to the Corporation's shareholders. One feature worthy of attention is the segregation given of the Rand gold output, giving the year ended June 30, 1908, which shows that the yield of £28,508,368 was accounted for as follows:

		Per cent.
To workings costs	£16,600,000	58.2
To dividends	8,000,000	28.1
To profits tax	740,000	2.6
To reserve fund, debenture redemption and interest, capital expenditure, etc	3,168,368	11.1
	£28,508,368	100.0

Further the total working expenditure is divided into the following items:

		Per cent.
White wages	£5,650,000	34.0
Colored and Chinese wages	3,400,000	20.5
Stores	6,300,000	38.0
Sundries	1,250,000	7.5
	£16,600,000	100.0

As the colored and Chinese outnumber the white employees by about 10 to 1, the aggregate wages of the two



Map of the African Goldfields.

classes indicate strikingly the significance of the distinction between skilled and unskilled labor on these fields, though allowance must be made for the free support of the Kaffirs and Chinamen.

The Robinson G. M. Co. bids fair to establish a brilliant record in the annals of Rand mining by declaring profits for a single year amounting to £1,000,000. At the present rate, this mine, with its single mill, should have recorded £990,000 by the end of 1908, but as the gold reserve has been increased to an extent warranting a substantial withdrawal in December, without causing risk of falling short in output during the ensuing year, there is hope that the round million will be reached. Those who may have been misled by labor-platform utterances as to the omniscence of the capitalist in the Transvaal since the war may ponder the startling fact that the Robinson mine, under the Profits Tax instituted in 1902 by the new régimé, will be called upon to contribute about $500,000 this year to the Colonial exchequer.

NEW YORK.

Mining Share Market. — Wash-Sales. — Copper Stocks. — Lake Superior Corporation.

During 1908 few new mines were promoted in New York, and well-established mining companies found it difficult to finance their operations. In fact, mining stock could generally be sold only at a discount. The New York Stock Exchange report states that the total number of shares traded in on the Exchange in 1908 amounted to 197,003,415, as compared to 196,438,824 in 1907. Not many mining shares are listed on the Exchange, and therefore few such stocks are included in the above figures. In New York, mining shares are chiefly traded in on the Curb Market, but the Curb Market simply reflects the operations on the Exchange. Although the total transactions in 1908 were larger than in the preceding year, it must be remembered that the operations were so abnormal that the State Government has been induced to inquire into the business methods of the Exchange. It appears that a certain powerful financial clique took advantage of the panic in 1907, and with the aid of money loaned by the United States Treasury, made enormous purchases of shares. These shares were carried over 1908 while the prices were rapidly advanced. As a consequence, it is impossible to doubt that the Exchange's statistics include a large number of wash-sales made with the view to advancing prices. It appears probable that efforts will soon be made to unload these holdings. This will absorb a large amount of available capital, and divert attention from mining finance. When, however, the public subscribes to the syndicate's holdings, and to certain railroad bonds, there will be a renewal of interest in mining. Such a revival may occur early next summer, and Nevada gold stocks will apparently be the first to respond.

The copper market continues in an apathetic state. It is claimed that copper production is nearly 30% in excess of consumption. In the last two years many new copper mines have been developed, and the metallurgical plants at most of the large producers have been greatly enlarged. Copper stocks now on hand in the United States are estimated at 70,000,000 lb., and in Europe, at 175,000,000. It would require an exceptionally rapid revival of business throughout the world to create a demand for copper sufficient to absorb the stocks on hand, and take current deliveries.

It is announced that Dennis Sheedy, of Denver, has resigned as one of the directors of the American Smelting & Refining Co. The board now includes five of the Guggenheim brothers, and several of the other directors are employees nominated by them. There has been talk of a compromise between the A. S. & R. Co. and the new International Smelting & Refining Co., but there is no warrant for the story. It is stated that the new company has closed contracts for a large amount of business, and some of it at the expense of the old company, whose Garfield plant has not been entirely a success and will have active competition from the new smelter now building in Utah. Much of this talk simply reflects partisan feeling and an effort to influence the stock market, in fact, the weakest feature in the position of the Guggenheims is their participation in the gambling on Wall Street. In this respect they have played the game like stock-jobbers rather than smelter managers, losing some of their reputation for conservative finance.

An English syndicate has purchased the properties of the Lake Superior Corporation and proposes to develop them on an extensive scale. The properties included in the sale are: the Ontario Lake Superior Co., Algoma Central & Hudson R. R. Co., Algoma Commercial Co., Algoma Iron Works,

Algoma Steel Co., Lake Superior Power Co., and many subsidiary companies operating iron, copper, nickel, silver, coal, and other mines. The sale was negotiated through Robert Fleming, of London.

Owing to the unfavorable conditions of the zinc and lead markets, the directors of the Continental Zinc Co. have decided not to declare any dividend for the past quarter.

CHICAGO.

Zinc Smelting at Coal-Mine Mouth. — Sulphuric Acid Production.— Metallurgical Differences Between Eastern and Western Zinc Ore. —Producer Gas in Metallurgy.— Mine Accidents. — Illinois Oil.

Zinc smelting in the Illinois coalfield continues to increase. Within the year just closed two new plants have gone into operation, and another, that of the Mineral Point Zinc Co., at Depue, has settled down to regular work. The plant of the Hegeler Brothers at Danville has been in process of building three years, and into it has gone the accumulated experience of generations of zinc smelters. It is excellent all the way from the mechanical roasters to the warehouses and the workingmen's cottages. Sulphuric acid is made as a by-product, lead chambers being used. At Depue, on the other hand, the contact process was installed, but dust is said to cause difficulty with this process where acid is made from the fume of zinc ore. It clogs the contact-mass and stops the circulation. Except at the original works at Mineral Point, Wisconsin, contact plants seem not to have done as well as the old lead-chambers in this industry.

At Danville the acid made is sold to the United Zinc & Chemical Co., which found itself unable this year to supply the demands from its works alone. The story is that at the beginning of the recent depression the manufacturing department of this concern found the sales department had not kept pace with the growing output of the Kansas plant. A protest was entered and the sales department, being put on its mettle, despite the business depression, promptly made more contracts than the manufacturing department could care for. The result was that the new plant of Hegeler Brothers was called on to help. This seems to show that last year there was business enough for those who went after it.

The new plant of the United Zinc & Chemical Co. at Springfield, Illinois, was erected by R. G. Hall, the superintendent, in record time, namely, approximately four months. No acid is made here as yet, though eventually an acid department will be added. The plant is closely modeled after that in Kansas, owned by the same company, and is run on Western ores, mainly from the Iron-Silver and Yak mines at Leadville. It is an interesting commentary on the skill of American zinc smelter-men that ores containing 14 to 17% iron are regularly charged, and still the retorts, made of the St. Louis fire-clay, and not hydraulically pressed, have a life of approximately 40 days. A few years ago such a result was considered entirely impossible, and probably would be still with Mississippi valley ores of the same iron content. Western ores, it seems, reduce at lower temperatures, 2100° as contrasted with 2800° for finishing temperatures with Joplin blende. Indeed, with Western ores the losses occur in the early rather than the later stages of the process. All this makes to the advantage of the coalfields. Costs at the smaller Springfield plant with producer gas made from cheap screenings, are said to be approximately the same as at the larger Kansas plant using natural gas. The higher thermal efficiency of natural gas, especially where used with regenerators, is not always economical, since it produces an intense local heat and causes high loss of retorts. This, by the way, is the same difficulty which has so far been found when attempts have been made to burn powdered coal under boilers; witness the work some years ago at the Twenty-sixth street plant of the Illinois Central railroad. In the long run the larger use of producer gas in metallurgical operations seems assured, and we may expect more and more smelting to be done in these coalfields, half way between mines and markets, when by-products will have a larger value due to greater density of population.

In that connection it may be noted that the Illinois Central is now considering the possibility of by-product ovens to coke Illinois coal and to furnish fuel for the engines on the Chicago division. This appeals to them as cheaper and simpler than electrification of terminals to abolish the smoke-nuisance. It has the advantage, to the railway, over central stations and electrical transmission from the coalfields, that it still gets the freight; and railways hesitate to decrease freight; even now this is true of this particular line, although it is short of motive power for handling the freight at present available.

Herman Justi, Commissioner of Labor for the Illinois Coal Operators' Association, and the pioneer among such commissioners, died suddenly at his home in Oak Park on January 1. He was a Kentuckian and a man of many excellent qualities. His part in the general movement toward collective bargaining and trade conciliation was notable and he will be widely missed. In December Patrick McBryde, who held a similar position in Ohio, also died, and M. D. Ratchford has just been appointed to his place. Both McBryde and Ratchford were among the early organizers of the United Mine Workers, while Justi was an attorney and not a laboring man. The large number of labor union officials who have become commissioners for the operators is noteworthy, and they seem to have been uniformly successful. W. D. Ryan, the retiring general secretary of the organization, is shortly to be made Commissioner of the Southwestern Operators' Association. At the annual meeting of the Illinois Coal Operators' Association on January 15, A. J. Moorshead, president of the Madison Coal Corporation, was elected president, and E. T. Bent, of the Oglesby Coal Co., secretary for the ensuing year. It is understood that no change of policy is contemplated. A strong legislative committee was selected and an effort will be made to secure a revision of the mining laws.

Accidents in the mines continue to happen. The Ziegler mine blew up again on Saturday, this time killing 26 men. The fire which caught in the mine in November had just been stopped off and work was to have been resumed Monday. The mine is sealed again to prevent fire, and all the work evidently will have to be done over. The Spring Valley mine No. 2, with its steel and stone bottom and steel topworks was supposed to be fire-proof, but it caught fire December 31 and was wrecked. The fire spread from the stables to the shaft and burned enough cribbing, above the bottom, to cause the tipple to fail; it collapsed as a tangled mass of steel beams. The loss, if the shaft can be recovered, will be approximately $50,000, otherwise it will be nearer a quarter of a million.

Despite the business depression and the intimate relations of the brick industry to building booms, the year seems not to have been a bad one for the brick-makers, Chicago brick ruled at about $5 per thousand, and one large out-of-town manufacturer got a factory price of only $3.50. Even at this, however, under right conditions, there is some money in the business, and numerous new enterprises are planned. Murphysboro is to have a paving-brick plant and also a new yard for making builders' brick. L. C. Davis is to start a plant at Jacksonville, and the St. Anne Brick & Tile Co. is planning to run all winter; an unusual thing to do in this field. To offset these, is the fact that the Millsdale Pressed Brick Co. has gone into the hands of a receiver, G. A. Little being appointed.

Final figures for the year's business of the Ohio Oil Co., the local representative of the Standard in the Illinois field, are now available and show pipe-line runs of 31,972,629 bbl. Miscellaneous receipts added 5,952,912 bbl. The output was distributed with extreme regularity throughout the twelve months.

In addition to this production, the 'independents', the Sun, Cornplanter, and Pure Oil companies, the Indian Refining Co., and the Robinson Refining Co., probably handled approximately 2,000,000 bbl., making a grand total for the year of nearly 40,000,000 bbl.

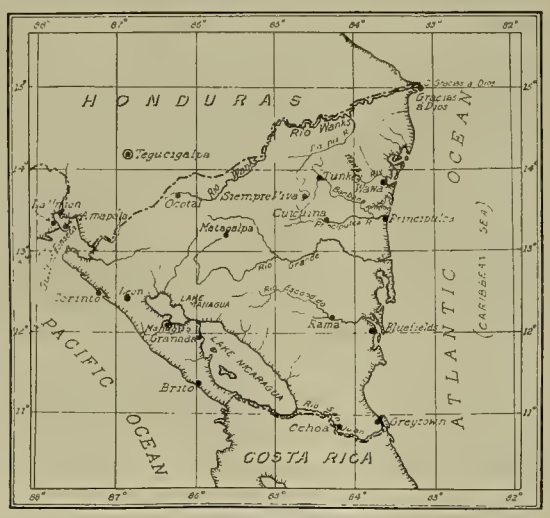
BLUEFIELDS, NICARAGUA.

Piz-piz District.—Siempre Viva Mine.—Gold Developments.—New Plant.—Hydro-Electric Installations.—Copper Discoveries.

An important gold-mining district has been developed in eastern Nicaragua, and numerous milling and electric-power plants are being installed. The region first became known in 1893 when the Siempre Viva mine was examined by Courtenay De Kalb in the interest of W. R. Grace & Co., of New York. The report was favorable, but difficulties with the original owners of the property led to the abandonment of the enterprise by W. R. Grace & Co. The mine was worked in a feeble way by the owners, and finally fell into the hands of Samuel Weil of Bluefields. Today it is operated by the Siempre Viva Mining Co., dominated by William Adler, of New Orleans. A 20-stamp mill has been erected, with a disintegrator for soft ore, and a small cyanide plant has been placed in commission. The company treats 2500 tons of ore per month, said to average $9 per ton. The mill is being enlarged and electric haulage is being introduced in the mine. The manager is R. B. Stanford. The Siempre Viva vein is of great longitudinal extent, being covered by three claims revealing over 4000 ft. of continuous lode with remarkably uniform gold content. The strike of the vein is northeast, the Concordia mine lying southwest and the Constancia northeast of the Siempre Viva. At the Concordia are 10 stamps and a disintegrator, and at the Constancia is also a 10-stamp mill, to which 10 more stamps will be added immediately, and plans for fine grinding for amalgamation are also being made. This property is owned by the Concordia Gold Mines Co., of New York, of which Gustav Henry Schwab, of the North German Lloyd Steamship Co. is president. The manager is W. A. Conley.

The great gold belt of the region, locally called the Veta Madre, parallels the Siempre Viva vein on the southeast side, and extends across country for eight miles. The largest plant of the district is at the Lone Star mine, on the Veta Madre. Here are installed 30 stamps with cyanide equipment. The deposit is from 50 to 150 ft. wide, and the ore is extracted at insignificant cost by quarrying. The mill treats 3000 tons per month of hard quartz ore averaging $6.50 per ton in gold. The property is owned and operated by Norman McGinniss, of Toronto, Canada, and William Bluett, of Berkeley, California. Farther northeast on the same lode is the Mars mine, yielding similar ore, which is treated in two Huntington mills, 3½ ft. diam. This property is owned by Charles Lobner and H. B. Sherrick, who are now obtaining bids on a 10-stamp mill and cyanide plant. They have installed a 75-kw., 2300-volt, electric-power plant at the great falls on the Piz-piz river, where 15,000 hp. can be developed at any time. An electric plant at the Siempre Viva falls, where 10,000 hp. is available, has for a considerable period supplied power to several mines in the district. On a cross-lode south of the Mars is the Bonanza mine owned by Joe Lapierre. Here 4000 tons of ore per month are treated in 8 Huntington mills. This plant has a cyanide installation, including leaching tanks and equipment for slime treatment by decantation. Mr. Lapierre is putting in a 200-hp. electric-power plant on a tributary of Tunkey creek, and he will soon replace his 3½-ft. Huntington mills with new ones 5 ft. diam. The high-grade mine of the region is the Josefina, where a $150 ore is being treated in two 3-stamp prospector's mills. The vein is from 2 to 3 ft. wide, the pay-streak being sorted out, and $10 ore being stored on the dump for future treatment. This mine belongs to Samuel Weil and associates, of Bluefields. About a mile and a half south from the Siempre Viva, on the watershed of the Banbana river, are the Rosa Lee and Colorado mines, owned and operated by N. J. Martin, of Cape Gracias á Dios, Nicaragua. He is erecting an electric transmission line 8000 ft. long, drawing power from the Siempre Viva plant. The equipment on the property consists of a 5-stamp mill at the Colorado mine, and a 3½-ft. Huntington mill at the Rosa Lee.

This mining district lies at the headwaters of the Piz-piz river, an affluent of the Wanks, which important stream empties into the Caribbean sea at Cape Gracias á Dios. The gold belt also extends over the divide into the watershed of the Banbana river, which empties into the Principulca. The latter reaches the Caribbean at the town of the same name in what was until recently the protectorate of Mosquitia, better known as the Mosquito Coast. By river the Piz-piz gold district is nearly 250 miles from Principulca, but the distance in an air-line will not exceed 80 miles. A mineral belt extends along the foothills of the mountains all the way from the Wanks to the Escondido river, 90 miles southward, and valuable mines have been found at Cuicuina on the Principulca river, 20 miles or more from the Siempre Viva mine, and at Walpatara on the Banbana. The Santa Rita mine at the Walpatara rapids was originally opened and successfully worked by W. D. Parker, for gold. It was bought by New York people, and the Santa Rita Mining & Exploration Co. was organized. Development soon revealed a copper vein 30 ft. wide, from which shipping ore of extraordinary grade has been taken. It is under the management of Clarence C. Semple, formerly



Map of Nicaragua.

at Cerro de Pasco, Peru, and a copper smelter will soon be erected under his supervision. Near the Santa Rita, 4 miles from Tunkey, is El Golfo mine, the property of José Arámburu, where a plant containing two 5-ft. Huntington mills is in operation. A tramway 5 miles long has been built from the mine to the Banbana river. At Cuicuina, the La Luz y Los Angeles mine is being opened on a large scale. A mill is being erected consisting of six 5-ft. Huntington mills and a cyanide plant. Gold in this district was orig-ally discovered at Cuicuina in placers, and exploited by Schultz & Son, of Wunta Plantation; some pocket mines in the vicinity have also yielded large sums erratically. The La Luz y Los Angeles now seems about to give renewed importance to the Cuicuina district. Gold has been reported from the Wawa and the Grand rivers, but no large deposits have as yet been proved; the Topaz mines at Rama on the Escondido river, however, have been shipping large amounts of bullion for several years. This property is remarkably situated, being within two miles of tide-water on the river, and only four miles from Rama, at which point fruit steamers from New Orleans touch several times each month. The plant operating at the Topaz mine consists of 20 stamps with a well equipped cyanide annex. It is controlled and managed by H. J. Brown, of New Orleans, and E. Adler & Co., of the same city, are associated in the ownership. A concession for exclusive prospecting privileges in a wide zone at the headwaters of the Principulca river has been granted to Paul Renér, the original owner of the Siempre Viva mine. The concession is for 25 years, renewable under certain conditions for a like period. Mr. Renér has gone to New York seeking capital.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

All chlorates are soluble in water, but for complete solution of the chlorates of mercury, tin, and bismuth, the addition of a little free acid is necessary.

Charcoal absorbs 9.25 times its own volume of oxygen, that is, condenses it in its pores. It is because of this property that charcoal, once ignited, continues to burn without a draft of air until consumed.

Arsenic would not constitute a basis for the profitable operation of a mine unless the ore contained other valuable products. Arsenic is produced in America wholly as a by-product, and its recovery is not profitable.

Centrifugal force is calculated as follows: multiply the square of the number of revolutions per minute by the diameter of the circle in feet, and divide the product by 5217. The quotient is the centrifugal force when the weight of the body is 1. This quotient multiplied by the weight of the body is the centrifugal force required.

Anvil blocks under mortars in stamp-mills were formerly much in use in South Africa, but are now being discarded, as the vibration is greater than when the mortar is anchored directly upon the foundation. When concrete mortar blocks are employed, the concrete is allowed to set three months before the mortar is placed upon it.

Nickel concentrates in matte along with copper, upon being blown in a converter. The iron can be quite completely eliminated by bessemerizing, without occasioning a large loss of nickel. This process is regularly practiced by the Mond Nickel Co., at Victoria Mines, Ontario, which treats nickeliferous pyrrhotite ores carrying chalcopyrite, similar to the ore at Sudbury.

Drift-bolts should be round instead of square, to develop the highest attainable tenacity. The holes in the timber through which a drift-bolt is driven should be 0.875 of the diameter of the bolt, and the hole in the timber into which the bolt is driven should be 0.8125 of the same diameter. These conclusions are based upon recent experiments made by the Sibley College of Engineering of Cornell University.

Calcium sulphate (gypsum) is soluble in water at normal temperatures. Different investigators give the proportions as 1 of gypsum to 361 up to 443 parts of water. The quantity dissolved increases with the temperature. Considerably larger quantities of sulphate of lime remain in a solution in which that salt has been produced by a chemical reaction. The specific gravity of a saturated solution of calcium sulphate at 15° C. is 1.0022.

Stream-tin, or cassiterite, remains in the pan when washing sand or gravel. It is usually black, but it is remarkable for its colors, varying from grayish white to brown, yellow, and red. It is usually opaque, but is sometimes transparent, when it is called 'rosintin'. The variety known as 'ruby-tin' has a gem-like transparency and depth of wine-red color. Cassiterite in gravel to the extent of 1 lb. per cubic yard would pay for working.

Sulphuric anhydride is the tri-oxide of sulphur (SO_3). Dissolved in water it forms ordinary sulphuric acid. It is produced along with sulphur di-oxide (SO_2) in roasting sulphide ores. The latter compound is a permanent gas, while the tri-oxide at ordinary temperatures is a liquid, and at 16° C. becomes a white solid. The white fume forming in the air above the stack of a roasting furnace is mainly SO_3. The pungent suffocating odor of fume from roasting sulphides is due to the dioxide.

A junior location, the boundaries of which are so placed as to confer extralateral rights, and which includes the apex of a vein, takes precedence, as far as the vein is concerned, over a senior location which does not include the apex of the vein, but underneath the surface of which the vein extends on its dip. The senior location is only entitled to that portion of the vein lying vertically beneath its surface which is not within the extra-lateral rights of locations properly including the apex of the vein. Priority of location is not controlling under such circumstances.

Ion is the name given to the parts into which a molecule splits up in solution. For example, hydrochloric acid dissolved in water ionizes, splitting into H+ and Cl—, the signs indicating the electric charges carried by the respective ions. An electrolyte is a compound capable of dissociation into such ions, and conveys electricity only by means of their migration. All metals and hydrogen are electropositive ions. The theory was first stated by Arrhenius in 1884, but the name 'ion' was applied by Faraday many years ago to the components of a substance conducting the electric current in solution.

The boiling test for cement is also called the accelerated test, because it reveals defects that would show themselves only after the lapse of time in concrete or cement mortar. The defect revealed is that of 'overliming', that is, the existence in the cement of an excess of free lime, which would cause expansion and disintegration in time. The test is made by preparing neat cement in the same manner as for making briquettes, and, with a spatula, applying the mortar to a glass plate 4 in. square; the pat is made in the form of a flat cone, 3 in. diam. at base and ½ in. high. It is kept in a 'moist-closet' 24 hours, and then placed in a pan of water; the water is brought to a boil and kept boiling 4 hours. Sound cement should show no tendency to checks or curling of the edges of the pats, and should remain adhesive to the glass, and the best cement retains its normal grayish green color unimpaired.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Engineer as a Financier.

The Editor:

Sir—In your issue of January 9, J. R. Finlay frankly endorses the view that "the engineer's work is essentially commercial work, and that its value is simply commercial." Taking the liberty of substituting 'economic' for 'commercial' in the sentence quoted, the statement is incontrovertible, and the argument is advanced by a definition. The engineer may take an occasional excursion into the domain of pure science, but it is usually done for the sake of bringing back something capable of economic application. Considered as an engineer, he is assuredly working for economic results. If he also undertakes commercial work, within the field of mining, he is engaged in buying and selling. This means trade in mines, and that is a business different in nature from professional work. This distinction Mr. Finlay will undoubtedly accept. By making it, the engineer as engineer is distinguished from the engineer as promoter. Mr. Finlay allies himself with a class of professional men who insist that it is the privilege of a mining engineer to identify himself with the financial side of speculation in mines. This class includes a large number of the foremost men in the profession, whose ability and integrity are above reproach. The MINING AND SCIENTIFIC PRESS has gone on record in approval of such practices as Mr. Finlay advocates. It said (July 18, 1908): "There is no moral wrong in an engineer holding an interest in a property which he has examined; there is not even any moral obligation which would require an honest man to decline contingent fees, granting that he believed his judgment would not be warped by the self-interest at stake;" but it was further declared: "It would certainly bias the minds of the vast majority of men to the point of incapacitating them for accurate examination, critical use of data, and sound justifiable conclusions." Precisely there lies the crux of the whole matter.

It is necessary for the engineer distinctly to recognize the economic responsibility involved in the proper discharge of his duties. From the initial stages of his apprenticeship, as an incumbent of inferior positions in mines and works, he is learning how to win results measurable by a monetary scale. The constant aim is a reduction of cost per unit of output. As manager, the problem of earning a profit is the motive underlying every administrative act. After such a preparation in the school of experience he may advance to the stage of advisor, assuming responsibility for valuing mines, and forecasting the economic outcome of projected mining ventures. It is concerning the duties of an engineer who has risen to this dignity that the question of professional ethics applies with peculiar force. He stands between the vendor and the stock-buying public; it is to his ability, integrity, and judgment that the public looks for safety. It was manifestly not intended by T. A. Rickard that "a man's work as a professional engineer should be quite divorced from his ideas as a business or financial man," as Mr. Finlay asserts. As far as the investing public is concerned, a purely technical report would be pointless. That is only half of the responsibility the engineer is obliged to assume. Unless he has the qualifications obtained through training and experience to perform both functions, he is unfitted to pose as a consulting engineer.

Mr. Finlay justly observes that "a man with natural bent for financial affairs cannot be kept from making financial ventures by any code of ethics." It may also be said that an engineer, frankly interested in a mining venture which has achieved success, wins prestige such that the public will follow his lead in financing new ones. This also works counter to the trammels of a code of ethics that would deny to him the advantage of participation in the profits of promoting enterprises. But therein lies the temptation to over-reach. The tendency has always been strong to over-capitalize mining properties; the element of chance has been insisted upon, and the prospective or indicated orebodies have figured too largely in the valuations reached. If the ore developed subsequently confirms a fortunate guess, the prophet is accorded the honor of a seer, and his next forecast is accepted with confidence. The result is to give a successful man opportunity for exceeding the limits warranted by demonstrable fact in his financial recommendations. This opens the way to disproportionate compensation in shares, which the public will readily absorb if the engineer should become afflicted with doubt concerning the ultimate success of the enterprise before the market had been weakened by sharing his scepticism. In this close relation between mining and the stock market exists the peril which reveals that the engineer stands on a different basis from the common speculator. He has a professional responsibility which is apart from and superior to the financial. To speak of a contingent fee in connection with these operations is to overlook the actual character of the relations now largely in vogue; the engineer gets fees, and also a contingent interest. How to sustain the good reputation of the mining engineering profession in the face of abuses growing from these practices is the difficult question. The engineer who abstains from contingent interests and depends upon cash payments for services rendered is undoubtedly in a strong and more distinctly professional position; his judgment would at least be free from the suspicion of personal bias. But, on the other hand, the engineer who chooses to cast his fortune with the enterprise he has helped to promote is in a position to direct its operations and to give to it the advantage of his supervision. A man engaged merely to examine and report is more often eliminated from the future conduct of the business, and another may fail where he might have seen the way to success. It may also be alleged that responsibility for success has a sobering and steadying

effect, and manifestly a man who is not in command can be held to account only for the seaworthiness of the ship. The outcome of a mining venture depends upon much more than the developed mineral, and the conditions for beneficiating the ore. There is accordingly much to be said in favor of a close financial relation between the advisory engineer and the enterprise to which he lends the authority of his name. The character and extent of that relationship, however, should be known. In publicity is found a salutary check upon irresponsible financeering. A law requiring publicity of all details connected with joint-stock company promotion has for some time been upon the statute books of Ontario, and similar laws have been proposed in the United States. It would seem that in this direction may lie a solution of the problem. It would, in fact, necessitate a larger participation in arranging the financial details of a company-flotation than is now enjoyed by the average engineer. Today the stock interest he possesses is too often a mere sop offered in the expectation of proving a stimulant to his rhetoric in the writing of his report. If the details were to be published as a preliminary to solicitation of stock subscriptions, the patent responsibility for both the financial arrangements and the technical facts would place the engineer in a position that would inevitably stimulate the exercise of prudence and conservatism.

COURTENAY DE KALB.

San Francisco, January 11.

Prevention of Fraud in Mining.

The Editor:

Sir—How shall mining frauds be prevented? Evidently there is much interest in the subject; it is right that it should be so, for the matter is important. The problem is a difficult one, and impossible of complete solution in this old gambling joint we call the world. But, putting my head-light on behind, I can see one effort in that direction, made way back of sunrise some twenty years ago, which may be not wholly without interest. It was the organization in Denver of a Mining Stock Exchange, on an unpatented scheme of protection and honesty. As the organizer of it, my gold of enthusiasm was soon transmuted into barren rock. I thought I held four aces and woke up and found I had but one. Preceding the birth of the Exchange for some weeks, the public was prepared for it by editorials in the daily press. With the tremendous daring of empty inexperience I promised that the public should have an honest deal, and I believed it would. That public swallowed the whole thing—bait, hook, and sinker.

The idea underlying its organization was to evolve a successful method of assisting men to get funds to develop prospects that gave unusual promise of value; to have rules such as would give a fair guarantee that funds would be honestly expended; to protect the public from fraudulent deals, and incidentally to furnish a market for the stock of such mining companies as would play fair in accordance with the rules of the game. The belief was that there was an abundance of money ready for mining speculation if people were satisfied of a good chance for profit and a fair deal. Events proved that the belief was well founded. If the same events also proved that other beliefs were composed of such stuff as dreams are made of, there is consolation to be found in the fact that to be a fool at times is an integral part of things.

The directors who launched the Exchange were among the leading mining and smelting men, financiers, and bankers in Colorado, in whom the public justly had confidence. In listing prospects, only those of unusual merit were selected; those listed under the first board of directors all made good, and are now producing mines. Every company was required to make a monthly report to the Exchange, stating the amount of money received during the month, and its source; salaries, commissions, wages, and all other expenses paid; amount and character of work done, and its results; and plans for future developments. These reports were open to the public. Stock was listed in two classes, one in a mining and the other in a prospecting class. In the latter only stamped treasury stock was good delivery on the Exchange. The first error was made in not providing that the common stock of the prospecting companies should be pooled until the prospect graduated into a mine. The second error was in not making the board of directors self-perpetuating.

The Exchange began business in a small hall, which was so crowded by the public that in a couple of days it moved to the Chamber of Commerce building. Soon that became too small and it moved into the largest hall in Denver. The public bought stocks as if it had gone insane. Exchange memberships which cost $100 were selling for $500 in a few days. The cost of listing was raised from $100, plus the cost of investigating the property offered, to $500 and cost, and applications to list came by the score. Soon an election for directors resulted in a new board, which changed the rules for monthly reports of companies so that they became a farce. As chairman of the Listing Committee I was constantly in the minority when voting against listing rag-tag and bob-tail holes in the ground, and I quit. The mermaid with so fair a form wound up in a slimy tail. The machine organized to protect the public became an instrument for the public's spoliation. Its members became the witches of old, to whom "fair was foul and foul was fair." The result was foreshadowed from the beginning.

Unless my philosophy is spavined, an exchange could be organized to be like a toy that is so weighted that, no matter how much it falls down, it will come head up, and be conducted so as to deserve and win public confidence, do much to promote honest dealing, be a benefit to that public which is always willing to take a flyer, and benefit honest mining and honest miners.

W. C. WYNKOOP.

San Francisco, December 22.

The executive and sales departments of the Pelton Water Wheel Co. will move on January 25 from the works, at 18th and Harrison St., to the Monadnock Building.

BLACK DIAMOND.

Written for the MINING AND SCIENTIFIC PRESS
By OSCAR H. HERSHEY.

The majority of prospectors are honest, but nearly all deceive themselves as to the contents of their prospects. I first heard of the Black Diamond, in Crescent City, California, as "A new strike of 600-oz. silver ore beyond Big Flat." Subsequently I met one of the owners, who described it as a vein 30 ft. wide extending through 12 claims, and carrying, according to 119 'tests' that had been made by a man who was studying assaying in San Francisco, from $3.70 to over $100 gold and silver per ton, a characteristic being the high silver content. This vein was described as at one place associated with a dike 1000 ft. long and 300 ft. wide, itself low-grade ore. Specimens shown were of a heavy black rock with some green malachite stain, which might be possible ore. I was traveling in Del Norte county in search of mines, and this appeared to be just what I was looking for, so I agreed to accompany the owner to see it, he to furnish camping outfit and provisions. On the first day I journeyed leisurely through the redwoods to a ranch on the summit of Bald mountain. The next day I walked on a rough trail 17 miles to Big Flat; on the way I waded the south fork of Smith river, and was also somewhat delayed by the red huckleberries that grew on the serpentine ridges. I was handsomely entertained at Big Flat by the forest guard, who bakes delicious blackberry pies; these pies reconciled me to the necessity of remaining a day to visit a neighboring copper prospect and to await the arrival of the Black Diamond prospector. On the fourth day we followed the old Kelsey trail over two sharp mountains; the prospector was on horseback, but on those rough trails I preferred walking as being somewhat easier, safer, and swifter. We finally arrived at the cabin of a hunter, whom I had been led to believe was a recluse and might be dangerous; but I learned to know him as a very fine man. My companion had depended on this hunter to furnish us a camping outfit and take us up to the Black Diamond. These men tried to treat me well, but unfortunately the bear meat was too old, and I was compelled to dine chiefly on flapjacks and the luscious blackberries that grew abundantly in the enclosure. I was pretty hungry until we met some fresh meat on the summit of the range next day. In the morning we climbed the main Siskiyou range, following the private trail of the hunter; the only incident of the journey was that one of our packhorses fell over a bluff. We camped that night in a beautiful clump of silver firs, on the edge of a tiny high-mountain meadow. Several times during the night deer approached the camp.

The next day was devoted to an examination of the Black Diamond property, which we reached by laboriously climbing over the rugged crest of the range. Instead of the vein traceable over twelve claims that had been described, I found an immense inclusion of red chert in a volcanic rock. It was originally a part of the Devonian blue bedded cherts that are widely distributed in northwestern California and carry some iron oxide, but are not otherwise notably mineralized except locally. The chert has in many places been greatly broken up by ancient volcanic action, and masses of it isolated in the lavas are common. The Black Diamond inclusion outcrops 800 ft. long and 100 to 300 ft. wide, courses northerly and dips steeply easterly. The heat of the surrounding lava had somewhat altered it and apparently concentrated the iron oxide from a great mass above into the lower part of the inclusion, producing a bright red chert abounding in thin layers heavily impregnated with a black iron mineral, some of which could be recognized in the field as specularite. It is also seamed with quartz, garnet, epidote, and hematite. At one place are traces of chalcopyrite and of malachite-stain in cracks; there are also slight traces of several unusual minerals. But there is no strong source of ordinary vein-action and the minerals present were probably all 'cooked' from the original constituents of the chert. I did not expect this deposit to carry appreciable quantities of gold and silver, but in view of the owner's positive statements I took three samples at places from which had been taken the samples previously assayed. One was cut across 5 ft. of the best mineralized streak; another consisted of many small pieces from the outcrop 75 by 500 ft., and the third from masses blown out by a blast in what was supposed to be the best ore. These three samples were assayed by a well known assayer in San Francisco, whose returns on each were 40c. gold per ton, and no silver. I am convinced that the prospector was honest; there was nothing wrong except a little misunderstanding in a matter of 119 'tests'. Besides illustrating the statement made at the beginning of this article, this Black Diamond story is intended to introduce into the literature of economic geology a rather unusual type of contact metamorphic mineral deposit, a very highly ferruginous chert-inclusion in lava.

Mixed Geography.—In a recent issue of the *Yale Scientific Monthly* is an address on the Mount Morgan mine, delivered by O. M. Colvocoresses to a senior class of metallurgists and mining engineers. The address begins in these words: "The Mount Morgan mine is best reached from Queensland, New South Wales, via Brisbane, Rockhampton, and the famous camp Gympie. Leaving Queensland on the late afternoon express, one arrives at the seaport of Rockhampton, 900 miles distant, in about 40 hours." A good many people, even in other parts of the world, may have been under the impression that it is not necessary to "leave Queensland" to get to our famous Mount Morgan, and that the State of Queensland is not in the State of New South Wales; but Mr. Colvocoresses claims to have been there, and, of course, he ought to know.—*Queensland Government Mining Journal.*

A large clock has recently been erected on the factory of Colgate & Co., in Jersey City, N. J. It has a dial 40 ft. diam., an hour hand 15 ft. long, and a minute hand 20 ft. long. The latter, with its counterbalance, weighs 640 lb. The clock is illuminated at night by 1200 four-candle-power electric lamps.

THE YUKON DITCH.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

(*Continued from Page 120.*)

The next division of the Yukon ditch is on Ballarat ridge; it includes both flume and pipe construction:

Ballarat. Elevation.

Intake of flume (4 by 6 ft.) at 2930 ft.
Discharge into pipe at 2927 ft.
Length of flume, 1100 ft.
Details of pipe (wooden stave).

Length, Ft.	Diam., In.	Staves, In.
9,300	42	1⅝
3,700	42	2½
200	42	1⅝
800	48	1⅝

Lowest point of pipe at 2543 ft.
Discharge into flume at 2769 ft.
Another length of flume, 650 ft.
Discharge at 2767 ft. Grade, 0.3%.

On the Ballarat ridge I watched the assembling and construction of the wooden pipe. The staves are cut to the radius arc. The butt strap, 5¼ in. wide, is a piece of band iron ⅛ by 1⅛ in. and a little longer than the width of a stave, so that the end jams into the next stave when circled by the bands. The rods are of steel. The shoes are made of malleable iron. The staves are made from 3 by 6-in. California redwood stock and planed to shape at the mill. The inside chord is 5 in. and the outside chord 5⅝ in. The pipe has 30 staves to the perimeter; each stave is of 2 by 6-in. (redwood). These are bound in ½-in. bands of round iron, tightened by means of a shoe and nut. The bands are spaced from 1⅛ in. to 10 in. apart, according to the pressure estimated; they come in the form of straight rods, and are bent to shape by being twisted round a turntable; they are then dipped in asphaltum paint, especial care being taken to coat the shoe thoroughly. I do not know whether this was done, but it should be, as the metal forming the shoe on most stave pipe-lines I have observed is lighter than the band, and hence will succumb to the corrosive effects of the weather.

Lepine Ridge.

The wooden stave pipe follows the top of the ridge between Ballarat creek and the watershed of Rock creek. The Ballarat flows into the Twelve-Mile, which enters the Yukon at a point 18 miles below Dawson, while Rock creek joins the Klondike at 15 miles above Dawson.

Intake of flume at 2752 ft.
2600 ft. of flume at 26 ft. above ground.
Intake of pipe at 2746 ft.
Discharge of pipe at 2638 ft.
14,660 ft. of 49-in. wood pipe.
11,887 ft. built in 1907, remainder this season.
Lowest point at 2556 ft. Several sags.

The flume along Lepine ridge is carried on a trestle until a height of 26 ft. is gained, in order to get the hydrostatic head necessary for the wooden pipe of 49 in. diam., namely, 7 ft. per 1000 ft. A head of 200 ft. is about the practical limit for the wooden staves; beyond that pressure the spacing between the bands has to be so close that the steel used (in the form of bands) is almost equal to that of a steel pipe. Under excessive pressure the water squeezes the wooden staves against the bands and destroys the life of the pipe. The wooden stave pipe is furnished by the Excelsior Wooden Pipe Co. of San Francisco. The pneumatic tool equipment comes from the Chicago Pneumatic Tool Co.; and the air-compressor from the Clayton Iron Works, Chicago. In building the steel pipe-lines, instead of using the ordinary slip-joints, which are merely driven together with a ram, each joint is riveted to its neighbor, and pneumatic tools are brought into service for this work.

Lepine Creek.

Intake of pipe at 2632 ft.
Discharge of pipe at 2118 ft.
Lowest point at 1282 ft.
Details of pipe:

Length, Ft.	Material.	Diam., In.	Thickness, In.
816	Wood	49	1⅝
2,160	Steel	47	⅜ to 3/16
1,108	Wood	49	1⅝

In crossing the valley to Lepine creek it was found necessary to sink 11 shafts to receive bents for the support of the pipe-line. The deepest of these shafts was 64 ft.; it was sunk in blue mud and wash, all frozen. The ground was thawed with a steam-point, 4 ft. at each thaw, so that the ground sank 2 ft., or 50% after each operation. The points were spaced 3 to 4 ft. apart. Owing to the batter (2 in 12) allowed for the posts, the deepest shaft was 9 ft. long at top and 29 ft. at the bottom. The bents are made of spruce, cut from trees 45 ft. long, 6 to 8 in. at the small end and 18 to 20 in. at the big end.

The behavior of wooden pipe in the climate of the Yukon is uncertain, for the life of the material is variable, but the cost is one-third that of steel pipe. I am informed that a redwood stave-pipe of 14 in. diam. has been in use at Nome since 1900 and has given satisfaction. The pipe brings water from Moonlight springs to the City of Nome.

Klondike Pipe-Line.

The largest single task on the whole line of construction was the installation of the inverted siphon crossing the valley of the Klondike river. The details of this line are as follows:

Intake at 2440 ft.
Discharge at 2240 ft.
Lowest depression at 1282 ft.
Details of pipe:

Length, Ft.	Material.	Diam., In.	Thickness, In.
760	Wood	49	1⅝
7,520	Steel	43	⅝ and 11/16
6,850	Steel	49	¼, 5/16, ⅜, ½, ⅝
1,629	Wood	49	1⅝

These data give an inadequate idea of the size of this particular undertaking. The Klondike valley is a deep wide depression, and crossing it with an inverted siphon involved the use of three miles of pipe, one mile of which is under a head varying from 1150 to 1000 ft., that is, the line had to be built to sustain a pressure of, approximately, 500 lb. per square inch. The hillsides flanking the valley are steep and this

presented engineering difficulties in the way of anchorage for the heavy pipe, as well as the handling and distribution of the material. Across the Klondike flats, which overflow each spring, the pipe is supported by a system of pile-bents, each bent being composed of four heavy piles driven into the bed of the stream. In crossing the Klondike the pipe is carried by a three-span steel bridge, each span 95 ft. long, mounted on piers, erected in mid-winter. Each pier is composed of piling surrounded by mortised timber, shod with steel.



Removing 'Muck' On Twelve-Mile Face.

The design and manufacture of this pipe involved the employment of engineering talent of the highest class, as practically each section of the pipe, on account of the pressure involved, had to be specially designed, and all of the bends and angles in the lap-welded portions calculated to a nicety. Practically the total length of the high-pressure portion is lap-welded pipe, furnished for the greater part by Riter & Connelley, of Pittsburg, although purchase of 1400 ft. was made in Germany. Some of the sections of the German lap-welded pipe are 36 ft. long, and weigh over four tons.

The excavation for the pipe-trench, the setting of the foundations, and the final placing and riveting together of the pipe, required the employment of over 300 men for nearly two summers, and the continual supervision of from one to three constructing engineers. The riveting and laying gangs worked day and night throughout the summer season. Five air-compressors, electrically driven, were employed on the work, as this line required to



Constructing Stave-Pipes on Lepine Ridge.



Shovel No. 5 in Operation.

be caulked both inside and out, as well as riveted. The last rivet was driven and the line completed on October 9, 1908, thereby closing the last gap in the construction of the main ditch system as far as Lovett gulch.

In building the ditch, many natural obstacles were encountered. They were overcome by methods suggested, for the most part, by experience gathered elsewhere in the North. The following examples will prove suggestive:

1. Frozen muck, where there is material for constructing the lower bank (see Fig. 1), is scraped by the aid of horses so as to accumulate on the lower side, and against the bank thus formed poles are laid close together, the points being placed 2 ft. below the grade of the ditch. Upon the poles is

spread a layer of moss or sod from 6 to 12 in. thick. Then dirt, or other good tamping material, is scraped, forming a slope 5 ft. from the toe of the moss, and inclined at an angle of 1½ to 1.

2. Fine silt or 'glacial' sand, which is frozen material that upon being exposed to the warm air, upon removal of the moss, thaws to a slime (see Fig. 2). In such material the ditch is dug 16 to 18 ft. wide,

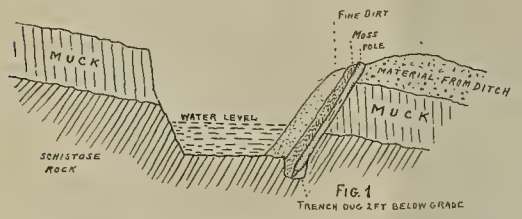


FIG. 1
TRENCH DUG 2FT BELOW GRADE

during the first season; the lower bank sloughs away; the upper bank melts, and the ditch is practically obliterated; but by maintaining open drains the whole mass is dried. In the second season the ditch is dug again, and the stuff that filled it serves to form the lower bank. Poles, moss, and fill are arranged as in No. 1. When the moss on the upper side is thick and remains unbroken, it drapes the underlying silt, which continues to run out like a thin mud until it finally attains the angle of rest; then the moss protects the bank from further thaw. When, however, the moss of the upper bank is thin or brittle, the silt slides into the cut, and must be scraped by teams to the lower side. In cases where



FIG 2

the lower bank is so uneven that poles cannot be laid regularly, two stringers are stretched longitudinally to serve as a base for the poles. These stringers are held in place by logs placed horizontally underneath the lower bank.

3. Shattered schist (see Fig. 3) is easy to dig, but it makes leaky ground. Digging is done by the steam-shovel and the ditch is made 14 ft. wide at the bottom. The corners are excavated by hand-labor, and filled with moss to a depth of at least 12 in. The bottom of the ditch is also blanketed with a foot of moss. On top of this is spread a covering (8 to 12 in. thick) of good puddling dirt, and the sides are given a slope of 1½ to 1.

4. A rocky slope, with no lower bank (see Fig. 4) offers another problem. On the lower side a crib of logs is built, with a base 6 ft. wide, and a top 4 ft. wide. This framework is filled with broken rock. Moss and puddling are applied as before.

It was no light task to take care of the men engaged in this work; they were scattered over a line reaching more than 50 miles from Dawson, the various camps being pitched in a wilderness of scrub and soggy moss. No supplies, either of food or material, are hauled in summer, for all the roads except those built by the Government near Dawson, are then impassable by heavy wagons. Hauling is done exclusively in winter. The stumps and brush are cleared in a line across the marsh and as soon as the frost comes a passage is effected. A plow removes any excess of snow, and the road is watered so as to give it a durable crust of ice. Logging-sleds from Michigan are used; the average load is 9 tons with 4 horses, and 11 tons with 6 horses. The maximum load is 15 tons, with 6 horses. It cost $2000 to set up a camp, and it cost $7000 to $12,000 to get a steam-shovel ready to work. Not less than $75,000 worth of horses were employed, the price at Dawson being $800 to $900 per pair.

The magnitude of the work accomplished by the engineers of the Yukon Gold Co. may be inferred from an enumeration of the tasks completed during the three seasons since the first surveys were finished: 7 dredges in commission; 3 mechanical elevators; a dam and reservoir (700 miner's inches for 40 days) on Bonanza creek, connecting ditches, flume,

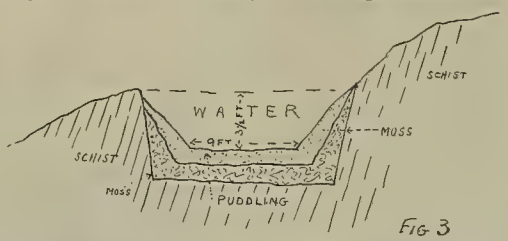


FIG 3

and pipe (aggregating 9 miles); a power-plant of 2000 hp., with 36 miles of main line, 18 miles of branch, and 8 miles of secondary lines; 64 miles of main ditch, flume, and pipe of 5000 in. capacity. All this has been done 3500 miles distant from manufacturing centres, with an inadequate supply of labor. Some of the machinery that arrived at the time of my visit had been ordered 18 months previously. The company was carrying 1812 men on its pay-roll, representing from 1600 to 1700 men continuously engaged. This called for an expenditure of $300,000 per month. In the examination of the claims purchased or optioned not less than $55,000 was spent.

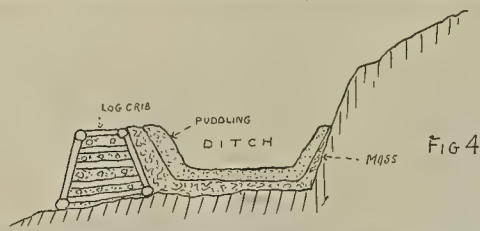


FIG 4

During the season of 1907 over 7000 tons of material was received, and it was inevitable that some of the parts ordered in advance, for immediate operations, should be delayed in delivery despite every effort. It is always difficult to operate when also engaged in construction work on a large scale. Moreover, some of the work was experimental, and the charges for this had to be absorbed concurrently with the capital expenditures. Of the 4 large dredges, 2 are of Bucyrus and 2 are of Marion manufacture, each couple being of the same pattern, so that the parts are interchangeable. The 3 smaller dredges are of identical design, and entirely interchangeable. A sufficient stock of parts is carried, so as to obviate



Discharge End of Pipe on the Little Twelve-Mile Creek.



Finished Ditch, Before Water is Admitted.

delays from slowness of transport. Maintenance of a proper commissariat for laborers scattered over an area 70 miles long by 30 miles wide, required some generalship. Laborers get $4 per diem and board, the latter costing the company from $1.75 to $2. An effort was made to overcome the uncertain supply of local labor by importing 320 men from British Columbia. Of these 20 deserted on the way. Owing to the shortness of the season, to the expense of travel, and to the opportunities for individual mining, it is difficult to keep intact a force adequate for so large an engineering work.

The supervision has been in the heads and hands of young men, mostly graduates from mining schools. The chief, O. B. Perry, is a graduate of the Columbia School of Mines; the resident manager, Chester A. Thomas, hails from Stanford University; the superintendent of dredges, E. E. McCarthy, is a Harvard man; the head of the hydraulic mining, George T. Coffey, is a graduate from the school of experience. Berkeley contributes two or three good men, but for obvious reasons Stanford is more largely represented; for example, H. H. Hall and E. A. Austin hail from Stanford. Most of these men range between 25 and 33 years of age, with a few youngsters, but it was noticeable that even the chiefs of divisions were not much over 30. They constitute a fine body of young and vigorous men, willing to make the most of the long Arctic day, and eager to hasten a work of which it can be said that it is the most interesting example of man's invasion of the trackless wilderness that borders the Arctic Circle.

NEVADA'S METALLIC WEALTH.

The mines of Nevada produced in 1907 gold, silver, copper, lead, and zinc to a total value of $17,591,486, according to final revised figures in a report by Charles G. Yale, just issued by the United States Geological Survey. The yield of gold alone was 585,311 fine ounces, valued at $12,099,455; and of the silver, at the average commercial price for the year, $4,675,178. The combined increase was $1,767,619.

There was an increase in tonnage of all kinds of ore mined. Out of a total of 723,581 tons, 628,501 tons were silicious ore, of which Nye county produced 241,677 tons, and Tonopah 214,357 tons. The average value per ton of silicious ore in gold and silver was $25; of copper ores, $6.65; of lead ores, $9.86; of copper-lead ores, $16.87; of copper-lead-zinc ores, $25.81; and the average value per ton of all kinds of ore was $23.10. During 1907 the gold and silver mills treated 436,779 tons of ore, from which were saved $2,785,634 in gold, or an average per ton of $6.38, and $1,400,039 in silver, or an average per ton of $3.20; a total value in gold and silver of $4,185,673 and an average per ton of $9.58. From 436,779 tons treated at gold and silver mills, and from 16,569 tons of copper, lead, and zinc ores sent to concentrating mills, a total to both classes of mills of 453,348 tons, 11,702 tons of concentrate was produced, valued at $445,642 in gold, or an average per ton of $38.08, and at $739,226 in silver, or an average per ton of $63.17, a total in gold and silver of $1,184,868, and an average of $101.25.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination.

W. E. H., Pioche, Nevada: Volcanic rock—basic andesite or basalt.

H. W., Burrough, California: Pyrite and chalcopyrite in mica schist.

W. L., Silver Peak, Nevada: No. 1, impure calcite with flakes of graphite too small for satisfactory proof; No. 2, gypsum.

J. H. P., Golconda, Nevada: No. 8, shaly rock with much kaolin and some pyrite; No. 9, shale, much weathered and charged with limonite.

C. W., Wadsworth, Nevada: No. 1, gypsum in a rock highly charged with limonite and containing minute traces of some undeterminable sulphide; No. 2, rock highly charged with limonite of unusually light yellow color.

J. Q. McG., Coldfoot, Alaska: Miscellaneous pebbles, quartz, manganese oxide, etc., with nuggets of white metal which exhibit the cleavage of native bismuth splendidly and give blowpipe reactions for that metal. A careful search failed to detect other elements present in these nuggets, which, therefore, are native bismuth.

R. B., Goldfield, Nevada: No. 1, granular quartz aggregate with limonite, kaolin, and small specks of iron pyrite; No. 2, pyrite in sheared quartz rock, of very fine grain, containing some kaolin; No. 3, abundant limonite and some pyrite in impure quartz rock; No. 4, mica schist (biotite mica); No. 5, granular quartz with some muscovite; No. 6, quartzose shale; No. 7, an aggregate of pyrrhotite in quartz, with chlorite and talc.

F. E. H., Coldfoot, Alaska: These metallic nuggets show the cleavage of native bismuth and give blowpipe reactions for bismuth only. The substance is completely volatile before the blowpipe. No indication of lead, sulphur, antimony, or arsenic was obtained. If elements other than bismuth are present they are not in sufficient quantity to be detected by ordinary blowpipe tests. Some of the nuggets have a fused appearance, as though melted before being sent in for determination.

J. H. P., Golconda, Nevada: No. 1, an aggregate of limonite and kaolin with mica and quartz in small amount; No. 2, an aggregate of kaolin, quartz, and limonite, possibly a weathered rhyolite or rhyolitic tuff; No. 3, hematite in quartz rock; No. 4, shale; No. 5, shale, much sheared, almost schistose; No. 6, a sheared quartzose shale, probably, with pyrite in elongate cubes. This development of pyrite resembles millerite but no indication of nickel was obtained. No chlorite could be determined definitely. No. 7, impure quartzite, traversed by quartz veins; No. 8, quartzite.

GOLD REGION OF THE STRAIT OF MAGELLAN.

By R. A. F. Penrose, Jr.

*The Strait of Magellan intersects the southern end of South America from east to west. To the north is Patagonia, and to the south is the archipelago of Tierra del Fuego. Both these regions are owned partly by Chile and partly by the Argentine Republic. The Chilean possessions in the Magellan region, on both sides of the strait, are officially known as the Territory of Magallanes, a term locally abbreviated to 'Magallanes'. Patagonia represents the southern end of the mainland of South America, terminating at Cape Froward, in the Strait of Magellan. The name of Tierra del Fuego properly belongs to the whole archipelago of islands lying south of the Strait of Magellan and north of Cape Horn. It comprises an area extending about 500 miles from northwest to southeast and about 200 miles wide. The two main tidewater channels are the Strait of Magellan on the north and Beagle Channel near the southern part, intersecting the region from east to west. There are numerous other minor and transverse channels, dividing the archipelago into many islands. South of the Strait of Magellan, in Tierra del Fuego, the western and southern parts of the archipelago are rugged and mountainous, some of the peaks rising from 3000 to 7000 ft. above the sea. This region represents the southern extension of the Andes, which here turn to a southeast course, and then to an east-and-west course, finally terminating in the rugged Staten island, the most easterly member of the archipelago. The northeastern part of the main island, however, is a more or less flat or rolling country, and partakes of the nature of the pampas of eastern Patagonia. Tierra del Fuego probably owes its condition as a group of islands to a partial submergence of the southern end of South America. The islands appear to be the upper parts of old mountain peaks, and the numerous straits, channels, and bays mark the courses of the old canyons and valleys. The rocks of southern Patagonia and Tierra del Fuego have not been much studied, but it may be said that they are mainly granites, various igneous rocks, and slates; while in the low pampas country in eastern Patagonia and the northeast part of the main island of Tierra del Fuego soft, sandy, and argillaceous strata predominate, probably Mesozoic and Cenozoic.

Gold is said to have been discovered in southern Patagonia by the Chileans over 40 years ago, and is supposed to have been known to the native Indians at a much earlier date, but it has been produced in quantities sufficient to attract general attention only in the last twenty years. The gold in the gravel of Rio de las Minas, near Punta Arenas, was one of the earliest discoveries. Another was the gold in the beach sands near Cape Virgins, at the eastern entrance of the Strait of Magellan, discovered about 1876, but not actively worked until 1884. An Austrian named Julius Popper was among the most active operators at that time, especially on the east coast of the main island of Tierra del Fuego. Gold was actively worked on both sides of the Strait of Magellan, but the principal localities were the gravels in the Rio de las Minas near Punta Arenas, the beaches at Cape Virgins, and from there southwestward along the shore to Point Dungeness; the gravels on several small streams to the eastward of Porvenir, across the strait from Punta Arenas; the beach at Paramo northeast of San Sebastian bay, on the east coast of the main island of Tierra del Fuego; Navarin island, Lennox island, New island, and Sloggett bay in the extreme southern part of the archipelago near Cape Horn; New Year island, which lies north of Staten island, at the eastern end of the archipelago; and several localities in the western islands of the archipelago. In fact, gold has been found generally distributed through the Magellan region.

About the year 1904 preparations to use steam dredges started the boom afresh. From all over Chile and Argentine again came the gold-seekers, with some from a still greater distance, and the usually almost deserted Strait of Magellan became animated with small craft. Since that time work on the gold deposits has steadily progressed, in a much more systematic manner than formerly. In 1907 some twelve dredges were in operation or being constructed, and the gold industry of the region promises soon to become important. The most active man in introducing dredges has been an American, John D. Roberts. The dredges are not used in handling the beach deposits, as the fury of the storms would soon batter them to pieces; their use has so far been confined to the inland deposits.

Until recently the largest gold-mining operations were at Paramo and Lennox island, but since the introduction of the dredges, the most active operations are on the northwestern part of the main island of Tierra del Fuego, across the strait from Punta Arenas. Here the town of Porvenir is the headquarters of the industry. This town is now a prosperous mining centre of about 800 people. In addition to the Porvenir region, mining on a small scale, but of more or less importance, is still going on at some of the other localities.

The chief centre of civilization in the whole region is the Chilean town of Punta Arenas, a name which in English means Sandy Point. The town is on the Patagonian side of the Strait of Magellan and has a fairly good harbor. It is the seat of government in this part of the Chilean possessions and is an active place of 12,000 population. The settlement of Ushuwaia, which is the seat of government of the Argentine part of Tierra del Fuego, is only a small place. Punta Arenas is in 53° 9′ 42″ south latitude, and has the distinction of being the most southerly town of any considerable size in the southern hemisphere.

Punta Arenas was started by the Chilean Government as a penal colony in 1843. The Chilean Government finally ceased using it as a penal colony and encouraged its settlement by free Chileans. For a long time it was the headquarters for sealing and whaling vessels, until the seals and whales became nearly exterminated. In recent years Punta Arenas has prospered, first by the development of the sheep

*Abstract from paper in *Journal of Geology*.

industry in Patagonia and later by the advent of the gold miner.

The gold of the Magellan region is, so far as at present known, most all in alluvial deposits. Very few gold-bearing veins have been found. The alluvial deposits may be divided into two classes, those in beds of creeks or on hillsides, and those on sea beaches where they are subject to the action of the sea during the falling tides and during storms. The alluvial deposits in beds of streams or on hillsides vary in gold content from a few cents to $1 or more per cubic yard, but most of the ground that is now worked is said to range from 25 to 50c. per yard. Under the conditions existing in the region, it is difficult to make low-grade ground pay, but some of the operators expect, with steam dredges, to make a profit on low-grade ground. The gold-bearing beds vary from a few feet to 10 to 30 ft. An overburden of barren ground often occurs.

The gold on the beaches is sometimes on the immediate surface and sometimes covered by from a few inches to several feet of barren sand. On some beaches it is well up on the shore, on others it is near the water-level, and on still others it is below the water-level. The sandy strata carrying the gold are rarely over a few inches thick, but often rich. The gold is associated with large quantities of black sand, which seems to be mostly magnetite; there are also numerous small garnets. The gold, whether from the creeks, hillsides, or beaches, is said to be quite pure, though it often contains a little copper and silver. It occurs generally in rather fine particles, but sometimes small nuggets, often flat and about the size of lima beans, occur, and occasionally still larger ones are found, but no great nuggets have yet been discovered. The gold in the beaches probably came largely from the later erosion of the alluvium in the creek beds and on the hillsides, and perhaps partly from old submerged alluvium, from which the gold was thrown up by the sea. It is said that the beaches, after having been carefully worked for gold, seem again to become rich in that metal after a storm or an unusually high tide. A similar phenomenon is observable in the gold-bearing beach sands of Cape Nome, Alaska. The ordinary tides in the eastern part of the Strait of Magellan have a rise and fall of 30 ft., and the spring tide, 45 to 50 ft., though in the western part of the strait the tides have a much less rise and fall. The great rise and fall of the tides on the Atlantic side cause rapid currents in the strait, often with a velocity of 7 or 8 knots per hour, and these, scouring the beaches backward and forward, must have a marked effect in concentrating the gold. In fact, the conditions in the Strait of Magellan represent a natural process of concentration, not at all unlike some of the artificial processes that man has found best suited for concentrating gold.

Prospecting in the Strait of Magellan and Tierra del Fuego is a more difficult task than in most places, and many a man has lost his life in his search for gold in that bleak, inhospitable region. Traveling is mostly done in boats, as the land is much cut up by deep tidewater channels and bays, and covered with dense underbrush or immense peat bogs; while everywhere, even on the mountain sides, the soil is soft and boggy, so that walking is difficult and often impossible. The climate, however, though stormy, is not extreme, the thermometer rarely going much below zero or much above 60° Fahrenheit. The mean winter temperature is about 33° F. and the mean summer temperature about 50° F. The season during which mining can profitably be carried on is from August to May. During the rest of the year frost and snow hinder operations. The capital at present invested in the industry is mostly Chilean and Argentine.

MEXICO'S MINERAL OUTPUT.

The annual budget sent to the Mexican Congress by Minister of Finance Limantour on December 14 gives some interesting figures as to the mineral output of the Republic. For 1907-08 the production was as follows:

Gold	₱ 38,096,000
Silver	85,447,000
Copper	24,800,000
Lead	5,400,000
Zinc	900,000
Other metals	2,500,000
Coal	7,000,000
Mineral oil	2,000,000
Total	₱166,143,000

Gold ore and bullion exports, minus Mexican and foreign gold coins exported, were 20,156 kilograms, or ₱26,874,705; gold purchased for coinage by the Exchange and Currency Commission, less ₱2,563,857 obtained from foreign gold melted down, 8316 kg., or ₱11,088,622; home consumption, 100 kg., or ₱133,333. The total production of gold for 1907 is 828,572 kg., amounting to ₱38,096,661, and for the year previous, 27,423 kg., or ₱36,563,898, an increase of 1149 kg., or ₱1,523,763. The exports of silver, minus those of Mexican and foreign silver coins, for the same time were 2,065,510 kg., valued at ₱82,192,655. Mexican silver bars bought for coinage, 85,504, or ₱3,174,249, with a home consumption of 2000 kg., or ₱80,000. The total production of silver for 1907-08 was 2,153,014 kg., valued at ₱85,446,904, while that of 1906-07 was 1,756,704 kg., or ₱77,088,877, an increase of 396,310 kg., or ₱8,358,077. In mineral output Mexico ranks first in silver, second in copper, fourth in lead, and fifth in gold, and, it is said, will establish a high record for this year with 86 of the most important mines owned by Americans. There are large amounts of American capital invested in the railroads, mines, and other industries, and three-fifths of the dividend-paying mines are held by residents of this country. From close figures it is said that the dividends from these will this year be over 25% in excess of the net earnings of all the national banks in this country, which during the fiscal year amounted to $79,863,898. Those banks, according to figures from the Wall Street Summary, paid only 5.46% earnings to capital and surplus, while some of the mines in Mexico rated as fourth and fifth rate are paying 10 and 15 per cent.

ACETYLENE MINE-LAMPS.

Written for the MINING AND SCIENTIFIC PRESS
By A. CRESSY MORRISON.

For several years acetylene has been used in miners' lamps in France, Germany, and Belgium, until at present it is used almost exclusively in more than 200 mines and by 50,000 men. The light is satisfactory, saves nearly 50% of the cost, giving more and better light. Mining engineers have been familiar with this fact, but the introduction of acetylene into mines, up to the last two years, has been very slow in this country. Its use is now, however, coming to be recognized as an important advance, and it promises shortly to replace all other means of illumination, except in special cases.

It is seldom that an improvement in quality or advantage is accompanied by reduction in cost, but the paradox is a reality in the case of acetylene. Candles, which are largely used in our Western mines, consume 7 times, and kerosene 5 times, as much oxygen as acetylene. The products of combustion given off by candles are 10 times, and from kerosene 9 times, as much as that given off by acetylene. The difference is therefore enormous. While acetylene in a mine gives off no smoke whatever, every miner is familiar with the difficulty due to products of combustion from other illuminants. Acetylene, therefore, makes for the life and comfort of the miners, protects them from the degenerating effects of insufficient oxygen, and removes the one important cause of lung and throat troubles. The actual amount of illumination given by candles and kerosene is lessened by the smoke and mist that so rapidly accumulate, whereas all the light given by acetylene reaches the point to be illuminated, without any interference whatever. It has been found, in actual experience, that in entries which are 60 to 70 ft. ahead of the air, there is not the slightest particle of smoke from an acetylene lamp, and the entry is just as clear at the end of a shift as it is at the beginning.

An interesting thing about acetylene is the tenacity of the flame. It is not easily blown out, the rapid motion of the miner will not cause it to flicker badly, and it burns brilliantly in an atmosphere so foul that candles fade and go out. In fact, acetylene will not deprive the miner of light until the atmosphere is so bad that it will not support life. For underground surveying and mine inspection, the use of acetylene is of great importance. Maps and records escape the usual accompaniment of grease and smudge. The acetylene flame is so small and clear that it affords an accurate point on which to sight instruments.

Another use for acetylene in somewhat larger units is found where the rays are concentrated by a reflector, in which case a brilliant illumination can be thrown into inaccessible places where distant bays, high backs, caved places, and other difficult and otherwise hidden parts of the mine can be explored with convenience and, in case of emergency, without danger. Acetylene is especially advantageous as a cap-lamp for drivers, and it has been found, where mules are used, that they can see much better and are not nearly so liable to stumble.

The poor quality of oil for mine use has in some States called for laws establishing a standard quality; these laws are frequently violated by a species of adulteration which almost defies detection, affording another powerful argument in favor of the substitution of some illuminant that cannot be adulterated. In this connection, it is interesting to realize that acetylene is made in the mine-lamp as used, the principle being the bringing of water into contact with the carbide as the gas is burned, and in just sufficient quantity. The difficulties of this problem have been overcome. As soon as the pressure of gas reaches the proper point for burning, it holds the water in check until the consumption at the burner has so reduced the pressure that the water comes in contact with the carbide again. In actual practice it has been found that four ounces of calcium carbide at four cents per pound will give nearly 10 candlepower clear illumination, without smoke, for 5 hours. One half-pound, or two cents worth, will give the same illumination for 10 hours. Candles in many parts of the country, counting four candles to the 10-hr. day, would cost five cents per day. There seems, therefore, to be no reason why acetylene should not be introduced, provided a proper lamp at an economical price can be devised. As a matter of fact, practical experience has demonstrated that some of the mine-lamps now upon the market meet all the necessary requirements as to economy, lasting quality, and practicability.

Acetylene mine-lamps are now found in mines throughout the country; Pennsylvania, New Jersey, and Illinois lead in this regard, though many other States are using the new light. The greatest number used by any one concern in its mines is probably by the New Jersey Zinc Co., of New York, which has adopted acetylene illumination throughout. The number of mine-lamps in use in the mines of this company is now about 3000, and it is found that the saving is at least two cents per day for every miner.

The whole method of using acetylene is so simple, and the lamps now in practical use are so satisfactory, that the subject of better illumination in mines is worthy of attention of every mine owner and engineer. It is equally worthy of the attention of every mining organization, as well as every individual miner, because a change to better illumination at half the cost, with the greater output, safety, comfort, and, above all, good health, are matters of such vital importance that no careful manager should fail to investigate the subject.

The Cullinan Diamond, which was presented to King Edward VII by one of the South African states, has been cut into nine stones. In its original form the stone weighed 3025 carats. The two larger stones weigh 516½ and $309^{3}/_{16}$ carats, and are five and three times larger, respectively, than the famous Koh-i-noor. Besides, there are 96 brilliants and a quantity of unpolished ends. The big stones have been cut with extra facets and are of remarkable brilliancy.

MILLING COSTS.

Written for the MINING AND SCIENTIFIC PRESS
By R. S. HANDY.

It is not generally good business practice to sell for less than cost, or to guess at profit and loss; and yet it is notorious that these two evils exist in most ore-milling plants in the West; that is, they generally contain some machines that cost more to operate than they produce, and, while the total income from the plant is determined accurately, the profit can only be guessed because the costs are not known.

This condition is not the result of inability to get at the costs, individual or total, in these plants, for they are operated by men at least as able as those who manage commercial or manufacturing enterprises of the same magnitude where close records of cost are kept. Indifference to the fine points of cost and efficiency in the milling of ores can only be explained by the lack of direct competition involving dollars and cents, the nearest thing to it being professional rivalry as to results obtained. If these milling plants had to bid in open competition with other mills for all of their ore, and there was not quite enough ore to go round, there would probably be some radical changes in the records of costs and efficiency in most of them, especially the successful bidders.

If a close margin of profit is conducive to reduced costs and increased efficiency, it can be introduced into any mill by assuming that the ore is bought from the mine on an arbitrary margin, the basis of purchase established being maintained throughout, whether it show loss or gain. For instance, in a certain mill the average experience for the preceding year shows a net profit of 40% of the average gross value of the feed. Then establish as a basis of purchase from the mine, say 38% of the assay-value of the feed on date of delivery to the mill. This will leave a 2% margin of profit under conditions existing for the previous year, and will establish a standard for comparison. But fluctuating conditions will make it interesting to keep the balance on the profit side of the ledger, and the figuring can be made as closely as if the ore were actually being purchased in this way. For example, a lead concentrator treating 1000 tons per day and working under the above assumption with lead at 5c. per pound and silver at 55c. per ounce, would make a profit of about $2000 per month. With the prices reduced to 4c. per pound and 50c. per ounce, the extraction and operating costs being the same, the result would be a deficit of about $500 per month. These figures leave a vastly different impression from the customary ones involving gross values of hundreds of thousands of dollars.

With the above assumption for a starter, the following suggestions might be applied for arriving at milling costs and efficiency. They apply, in this case, to a lead-silver concentrator.

1. Get the dry weight of ore milled each day.

2. Arrange the feed-sampling apparatus so that the assay of the feed represents the actual contents of it, rather than an abstract figure on an assay report.

3. Have the spouts carrying the concentrate discharge into a trunk launder for each class of product and let these discharge into their respectibe bins in such a way as to admit of easy time-sampling.

4. Have time-samples taken hourly of the different classes of concentrate from the above launders and the total sample for 24 hours of each weighed and sampled for moisture and assay in such a way that the least time will elapse between the end of the sampling period and the assay results.

5. Calculate the gross value of the marketable mineral content of the feed and of the product each day at the market rate for that day. The ratio gives the extraction accomplished.

6. Assume a constant as cost for the ore at the mill, say, a certain percentage of the assay-value, as a standard for comparison.

7. Figure the actual profit from shipping the different grades of product in No. 4.

8. Find the net daily profit by subtracting No. 6 from No. 7 and the daily cost of operating from the result.

9. Have each machine in the mill arranged for sampling its feed and products separately by time-sample, if possible.

10. Number each machine and determine the cost of operating it for 24 hours. Place these data on the sheets in the Test Book (See Fig. 2, 3, and 4) described hereafter. Index the Test Book with as many cross-indices as will enable you to turn at once to any given machine.

With the above data in shape you can, with practically the same amount of labor as is now devoted to sampling and assaying grab-samples of tailing and products from which no tangible results can be obtained, get actual results in dollars and cents each day, showing very closely the profit from operations and the efficiency of the plant.

The test-sheets enable you to have a number of tests made each day on individual machines, depending as to number upon the capacity of the assay-office and the sampling force. These tests should be made systematically, but not in regular rotation, so that the operatives, knowing their machines to be next in order, could have them in apple-pie order for the occasion. If these tests were made impartially, regardless of the conditions under which the machine is running, some interesting data could be gathered as to the losses from machines working badly temporarily. These data, I believe, cannot be gathered from 'experience.' The above system would undoubtedly tend to increase the efficiency of millmen.

Referring to Fig. 2, 3, and 4: these are forms for the Test Book, they are suggestions for a lead-silver concentrator and are self-explanatory. No. 2 may be used, by adjusting the details, for crushers, rolls, conveyors, elevators, Huntington mills. No. 3 for jigs, Wilfley tables, vanners, etc. No. 4 for trommels, screens, classifiers, and so forth.

The daily report blank, Fig. 1, follows the suggestions numbered 1 to 8, inclusive, above, and is lined for 31 days, for totals and averages; and lines for comparing the totals and averages with the regular monthly report based on actual shipments.

DAILY MILL RECORD.

SHOWING PROFIT ON ASSUMED STANDARD ORE COST

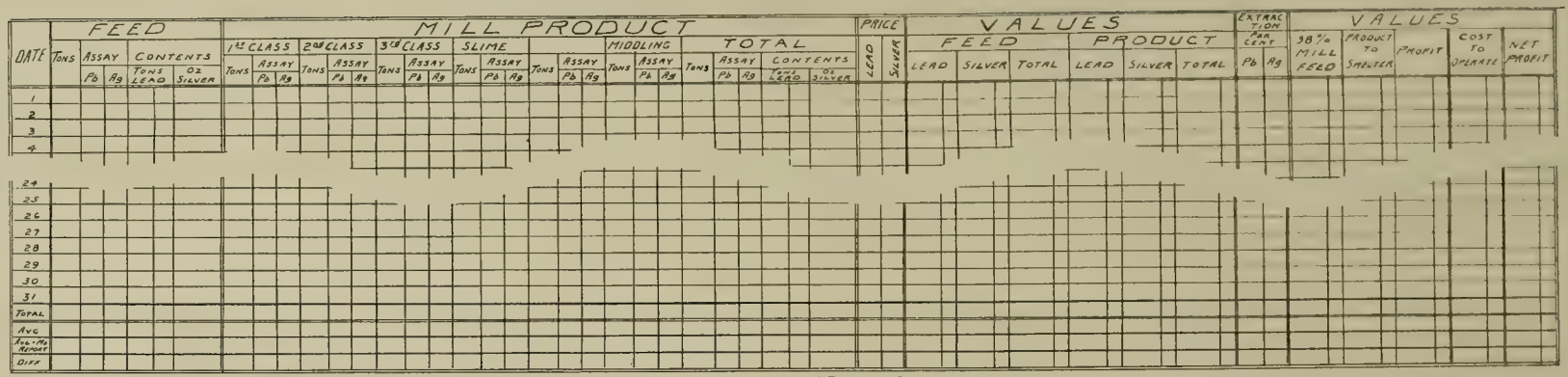


FIG. 1

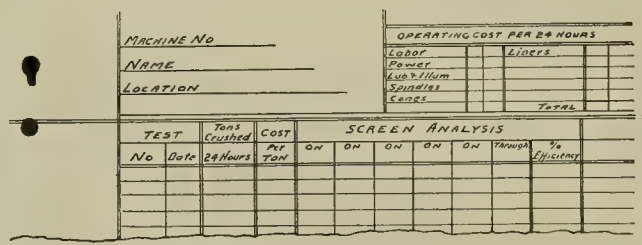


FIG. 2

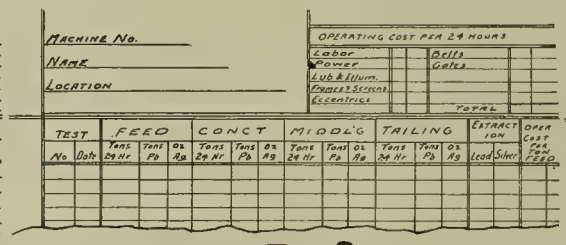


FIG. 3

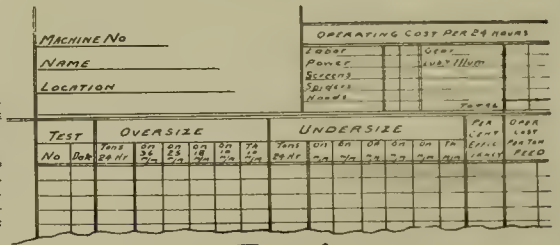


FIG. 4

BROKEN HILL SILVER MINE.

By E. C. Andrews.

*Having spent a week at the Broken Hill silver mine, I prepared a short note on the occurrence of ore, of which the following is a summary. Several geological facts become at once apparent. Thus: (1) The Broken Hill area is a mass of crystalline schists and allied rocks, all possibly pre-Cambrian in age. Garnets and sillimanite are characteristically developed; pegmatites and quartzose masses also form irregular segregations or lenses along planes of schistosity. Replacement of schists by pegmatites is a common feature. (2) The general strike of the schists is remarkably uniform, being approximately in a northeast and southwest direction. (3) The outcrop of the Broken Hill lode has the same strike as the country rocks. (4) Three belts of schists occur in immediate association with the lode, namely: (*a*) A belt of dense gneissic rocks and amphibolites forming its eastern wall; (*b*) a similar belt forming the western wall; (*c*) a soft, weak, and well laminated series of mica schists and allied rocks, some 660 ft. in width, alongside of and through which the Broken Hill ores occur. (5) At the surface, and in the opencuts, the lode appears to partake of the nature of a fissure developed along a plane of schistosity. At certain places along the lode outcrop the weak schist mass of the hanging wall is highly contorted; nevertheless, no sympathetic foldings of the schists forming the associated dense country are observable. The weak schist-mass never leaves the fissure, but preserves the same general strike as the latter, with marked local deviations from this direction. In general aspect it is analogous to a roof of corrugated iron which has the same general strike and dip as that of the frame to which it is attached, and yet has numerous puckerings or corrugations, causing marked local deviations from the general strike. (6) The ore masses apparently developed are to the west of the fissure. An exception to this appears to occur in the Proprietary mine. (7) The ore masses are, notably, replacements: (*a*) along the fissure itself; (*b*) along weak layers in the schist corrugations. Such shoots of ore have steep southwesterly pitches to the south of Block 14, and a steep northeasterly pitch to the north of the same property. (8) At first sight the shoots are strikingly suggestive of saddle-reef formations. They, apparently, curve sympathetically with the corrugated foliation planes. (9) The so-called saddles, however, are intimately related to the fissure or foot-wall; they are generally continuous with it on one side—appearing to spring out of it—and though their longer axes are not strictly in the same plane as that of the foot-wall or fissure, they are so intimately related to it as to suggest their absolute dependence on it for their existence. (10) The saddles do not occur in the strong schist belts, and are not found outside of the weak crumpled zone. Underneath the shoots or saddles the foliation planes exist in anticlinal form, ore and country having a familiar general curvature. They do not, however, represent filling of fissures formed between folded planes, but represent rather the replacement of huge masses of weak schist structures; for throughout the huge stopes abundant traces of the numerous foliation planes may be seen entirely traversing the ore masses. Horses of 'mullock' occur, completely surrounded by ore, yet so disposed as undoubtedly to represent remnants of crumpled schists in place, and not fragments filling fissures. On the upper portions of the 'saddles' the ore commonly grades into the country. (11) The fissure is not characteristic of the zone of fracture. It is rather insignificant in itself, and is important only by reason of the intense activity of the solutions which rose along it. The ore-associates also point to a deep-seated origin for the lode. Thus garnets, rhodonite, secondary mica, and quartz are abundantly represented. Fluorspar also occurs.

The deductions from the foregoing are as follows: a series of rocks occupying the Broken Hill area had been changed to crystalline schists. Garnetiferous schists, pegmatites, and amphibolite had been developed while basic cross-dikes had been altered into schists. One belt of weak, well laminated mica schists and allied rocks had been developed between two resistant series. Either the intensely laminated appearance of this weaker belt was due to original structural weaknesses or, as seems more probable, to the shearing of two dense rock series upon each other. Later, a narrow but strong fissure was formed along this line of weakness (plane of schistosity). A rotatory movement apparently now acted powerfully on the weak schist buffer. Strong parallel corrugations were developed in it. These were arranged vertically under each other north and south of Block 14, and their main axes lay mainly in planes approximately parallel to, and alongside of, that of the fissure. Individual corrugations represent so many flexings of the same schist belt. Heated waters—or water and water vapors—rose along the fissure and replaced the weaker schist foliae of the associated corrugations. In the presence of great pressure and strong reagents (hydrochloric, hydrobromic, hydrofluoric, and other acids), they simultaneously attacked the weaker walls of the main fissure and the intensely laminated foliae of the corrugations. The stronger layers offered greater resistance to percolation of the waters and thus a saddle-like set of ore-masses was developed. Firstly an intense silication occurred with later great development of amazonite, rhodonite, garnet, also zinc, lead, and silver sulphides. In many cases an imperfect replacement occurred, permitting the tracing of the various stages in replacement.

The geologic permanence of this field is thus suggested. The economic side of the question cannot be satisfactorily discussed until the corrugations (and the fissure) so far exposed by actual mining operations have been carefully examined, so as to apprehend the scheme of crumpling—if any such exist—and the class of schist or schist-structure most amenable to replacement. A knowledge of the varying quality and character of the orebodies with depths so far obtained is also necessary.

*Paper in *Economic Geology*, Vol. III, No. 7, 1908.

METAL DISTRIBUTION IN THE VEINS OF SCANDINAVIA.

By Hjalmar Sjögren.

*As several of the Scandinavian mines have been worked for centuries, our knowledge of the distribution of the metals in the different parts of the deposits is based on long experience. To begin with, I will give a few instances of the decrease of the copper percentage with depth in some of the principal copper mines in the Scandinavian peninsula. These occurrences we must consider as primary features. The rock-surface of the Scandinavian peninsula was, during glacial time, so deeply eroded that all products of surface weathering which had gone on during the greater part of Mesozoic and Cainozoic time were removed by the ice. The ore deposits of the Scandinavian peninsula are thus in general to be considered as the roots or the deeper parts of the original deposits, now laid open for observation, and in this respect they claim special interest.

The famous Falun mine has a history which can be followed for 750 years. Until the end of the nineteenth century it yielded more copper than any other separate mine in the world, having produced, in round numbers, 500,000 tons of copper, 15 tons of silver, and 1 ton of gold, representing a sum of about 1000 million Swedish crowns or about $27,000,000. The pyrite occurs enclosed in a quartzitic rock derived from the surrounding granitic gneiss, which is Archean. This metamorphism, which probably took place in connection with the formation of the ore, consisted in the solution of the greater part of the basic constituents of the granite, so that the remaining rock consists almost exclusively of silica. The ore-bearing rock is traversed by eruptive dikes, acid as well as basic, of felsitic and dioritic nature. A connection between them and the formation of the ore has not, however, been ascertained. The largest orebodies at Falun are stocks of pyrite of conical form, with points downward. The largest of these stocks ceases at the rather moderate depth of 332 m.; no continuation of it has been found. The pyritic orebodies are enclosed in peculiar rock-masses consisting chiefly of talc and chlorite (skölar) and carrying several minerals of secondary origin. The 'skölar' enclose the conical orebodies and separate them from the surrounding quartzite; they thus get a shape which may be compared with cornets, filled with the pyritic masses.

The distribution of the rich copper ore was chiefly close to the inner side of the skölar and in the skölar themselves. Their central parts contained much less copper. There is also a general decrease of copper with depth.

In recent years an ore containing about 3% Cu has been mined, and the ore percentage has been 33%, that is, the average amount of Cu obtained from the rock mined has been 1%. In the older parts of the mine, according to tradition, a far richer ore was obtained, probably yielding 10% Cu or more; otherwise an annual production of more than 3000 tons of copper would have been impossible.

A similar case is presented by the mines at Atvidaberg, which also had their palmy days in past centuries and were abandoned about thirty years ago. The Bersbo mine, where the deposits are now being explored at a depth of 410 m., and the Mormors mine, which, when abandoned, had reached a vertical depth of 407 m., are now the deepest mines in Sweden. The ores, which in the Bersbo mine occur at the contact with a diorite body, consist of copper pyrite, pyrrhotite, and sphalerite in a quartzose gangue. In this mine the decrease with depth both of the dimensions of the veins and of the copper percentage of the ore is observed. A striking feature in the Bersbo mine is the downward increase of the zinc-blende with proportional decrease of copper.

The above two examples are taken from among deposits of the Archean system. Instances of the same kind regarding the decrease of the copper percentage with depth are afforded by the numerous pyrite deposits associated with gabbro and occurring within the metamorphosed Silurian schists that constitute a great part of the high mountains of the Scandinavian peninsula. Such an instance is Vigsnäs, on the western coast of Norway, a fairly large deposit, that yielded, from 1865 to 1894, 900,000 tons of pyrite and copper ore. The deposit consists of a system of veins in gabbro, which rock in the parts adjoining the veins is altered into a schistose chloritic rock. In the upper parts of the deposit the average copper content was 2 to 2.25%. This percentage, however, decreased quite regularly with depth, being at the greatest depth attained, namely, 735 m., reduced to less than 1 per cent.

Vigsnäs is a deposit with a high dip—at least 70°. The numerous deposits of the same type that have a flat position present different features from those of Vigsnäs with respect to the copper percentage. In them no decrease of the copper is observable, when followed in the direction of the dip even to a considerable length.

The mines of Röros and Sulitjelma offer instances of this. In the former of these mining districts, where one can look back on a period of 250 years of mining, the pyrite bodies have been followed, in the Storvarts mine, 1350 m. with a dip of 8 to 10°. In the Mug mine, also with an average dip of 8 to 10°, the orebody has been followed 1080 m.; in the King's mine (Kongens Grube), in which the ore lies partly horizontal, and where in places it has a very slight inclination, the deposit has been followed no less than 2000 m. in the direction of the dip, without any observable change as to the copper percentage of the pyrite. At Sulitjelma the case has been found to be the same, though the orebodies there have a somewhat greater dip than at Röros, not amounting, however, anywhere to 30 degrees.

It thus appears that there is a decided difference between deposits with a low degree of inclination (30° or less) and such as have a steeper dip, the copper percentage of the former continuing the same with depth, while in the latter it decreases rather rapidly as the deposit is followed downward. This

*Abstract of paper in *Economic Geology*, Vol. III, No. 7, 1908.

rule is valid with regard to the deposits in Archean rocks (Falun and Atvidaberg) as well as to those of Silurian (Vigsnäs, Röros, Sulitjelma), and therefore seems to be universal.

This fact can, according to my view, be accounted for only by assuming the copper in the said deposits to be a function of the vertical depth, and the formation and precipitation of the copper substances from the magmatic solutions to have been dependent on the hydrostatic pressure that existed at different levels below the surface as it was when the ores were formed.

The above circumstances are evidently not only of great theoretical interest, but of equally great practical importance. For it is obvious that in the valuation of a pyrite deposit of this type one must attach far greater importance to the inclination of the deposit than has hitherto been usual. It follows from the above that a pyritic deposit of this type, other things being equal, must be considered of higher value, if it has a flat or slightly inclined position, than if it stands more vertically.

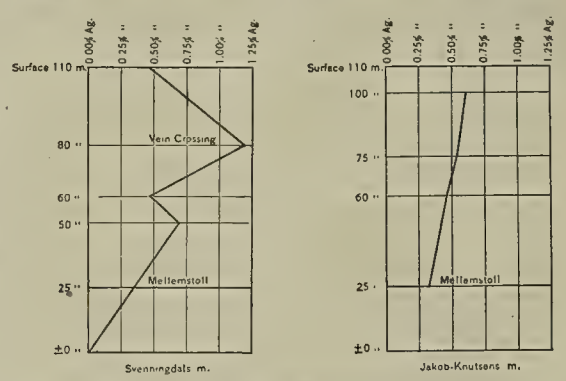
Also with regard to the lead and silver mines, experience warrants the same conclusion. The oldest and most important silver mine in Sweden is the Sala mine, which has been worked for more than four centuries on a metasomatic deposit in dolomitic limestone. The mineralization obviously started from a system of fissures (skölar) which with depth join in a trunk fissure (the Great Sköl), which traverses the deposit longitudinally. The percentage of lead has, on the whole, notably decreased downward, so that no more sinking has been carried on during the last 20 years, the greatest depth being now 320 m. Mining is going on exclusively on the higher levels in such portions of the ore as were formerly regarded as too poor to hoist, but which, however, are richer than the lower portions of the deposit in general. With increasing depth a general 'dilution' of the deposit through dolomitic limestone is observable. The silver value has decreased still more rapidly than the lead percentage; the rich silver minerals which, together with argentiferous galena occurring on the higher levels, namely, silver amalgam, argentite, and native silver, not being found at greater depths.

Another deposit of similar nature, though of smaller extent, is the lead-silver mine of Kallmora, Wästmanland, which has been worked on an argentiferous galena lying in limestone. Even at a depth of about 200 m. this deposit was found to be so strongly 'diluted' with lime that the working had to be abandoned.

An interesting instance of decreasing percentage of metal with depth is afforded by the silver mines of Svenningdalen, in Norway. They were worked on a system of parallel veins traversing at right angles a series of schists and limestone beds of Silurian age, as well as an intrusive granite. The argentiferous minerals in Svenningdalen are, besides a galena, containing about 1.5% Ag, fahl-ores rich in silver and proustite.

As the system of veins in Svenningdalen has been followed only to a depth of 100 m., it might be supposed that the decrease of the metal percentage at that depth is but accidental, but the fact that the same relations occur in the two mines, the Svenningdals and the Jakob Knudsens, indicates that it is not accidental. The mines of Svenningdalen also offer instances of the enriching influence of vein-crossings; a rich bonanza was found in the crossing between the main vein of the Svenningdal mine and the so-called southwest vein. Also in the Jakob Knudsen mine it has been observed that the metal content is richest at the vein-crossings.

From the copper and lead-silver ores here mentioned the Swedish iron ores differ with regard to the constancy of metal percentage; in these ores no general decrease of the iron with depth has been shown. These ores, so far as they belong to the Archean formation, are referred to two classes. One class comprises ores associated with basic eruptives of the gabbro group; they are products of magmatic differentiations which have taken place in the rock magma itself. Owing to their high percentage of titanium and their often low percentage of iron, they offer great difficulties to the metallurgist, and though there are vast supplies of these ores, they



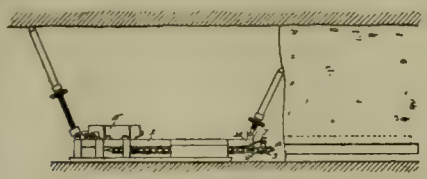
Graphic Representation of Decrease in Silver-Content With Increased Depth.

are as yet of no commercial value. For the ores of the other class, which occur associated with metamorphosed quartz-feldspar rocks of eruptive character, such as granulite, hälleflinta, syenite porphyries, and others, I have proposed the name dia-magmatic. They are evidently genetically connected with the aforesaid quartz-feldspar rocks, but have been produced through a differentiation process in a deeper zone, by which the iron-magnesia-lime-bearing material has been segregated from the silica-alumina-alkali material, and, being kept in solution through water and other mineralizers, has at the later stage formed epigenetic deposits. This is the same type to which C. K. Leith has recently proposed the name 'pegmatite type.' Ores of these classes have, it is true, undergone changes in the surface zone affecting the degree of oxidation of the iron; moreover, the minerals of the pyroxene and garnet groups have given rise to amphiboles, and to epidote, chlorite, and talc minerals, but on the whole the ores show no changes in richness of metallic value toward the depth. If, as is frequently the case, individual orebodies cease even at slight depths, they are in such cases followed by others of the same character.

MINING AND METALLURGICAL PATENTS.

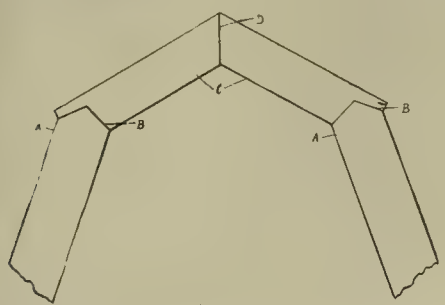
Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING MACHINE.—No. 906,221. William G. Halbert, Danville, Illinois.



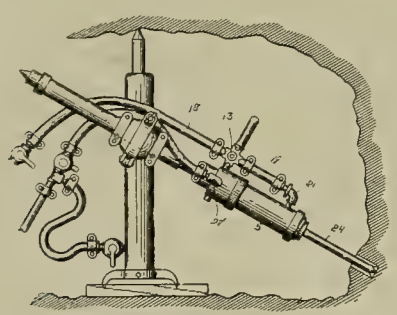
In a mining machine, the combination, with a carriage, and a cutter chain adapted to travel about the same, of a sprocket wheel mounted on said carriage in engagement with said cutter chain and having a hollow hub journaled in said carriage, and a supplemental cutter having a shank of substantially the same length as said hollow hub, slidably mounted in said hollow hub and held against rotation therein.

MINE-TIMBER.—No. 907,554. Zacariah Z. Ansbach, Silver Creek, Pennsylvania.



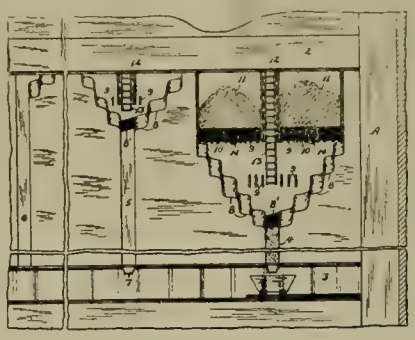
In combination with a pair of opposite side timbers inclined toward one another so as to have the least space therebetween at their upper ends, with inverted V-shaped projections on said upper ends, a pair of roof timbers formed with V-shaped notches on their outer ends and their under sides adjacent said outer ends to receive said projections of the side timbers, said roof timbers having their meeting ends beveled and abutting one another.

DRILL-HOLE CLEANING ATTACHMENT FOR HAMMER-DRILLS.—No. 907,430. Daniel S. Waugh, Denver, Colorado.



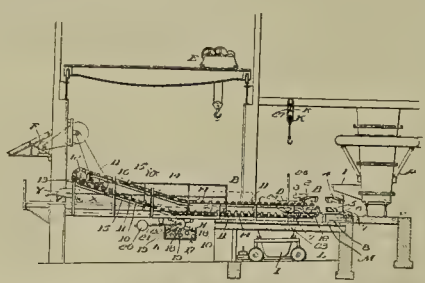
A drill body provided with a hollow drill bit, a conduit connected with the forward end of the drill body for delivering the drill-hole cleaning fluid to said hollow drill bit, a valve body interposed between the forward and rear members of the said conduit and threaded in the body of the drill, the valve piece passage therein located in said valve body, a connection between the motive fluid receiving portion of the drill body and the chamber of the valve whereby motive fluid is supplied from the drill body to the valve, the valve being capable of adjustment to allow the motive fluid to pass through the forward member of the conduit while communication with the rear member is cut off, or to open communication between the two members of the conduit while the motive fluid is cut off, and suitable means for delivering motive fluid to the drill-hole independently of the operation of the drill, substantially as described.

METHOD OF MINING.—No. 906,765. William G. Anderson, Smuggler, Colorado.



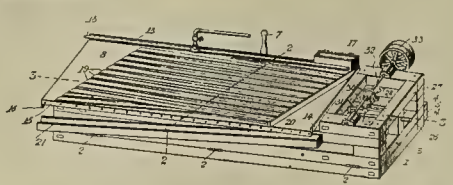
The method of mining which comprehends running levels along the orebody, connecting these levels by a suitable passage way, working out the ore on each side of the passage way by a system of benches, putting stulling and lagging into the worked out stopes, and filling the waste material into the vacant stope on top of this lagging, carrying down manways with the stope and collecting the broken ore at the bottom of the passage way in a chute.

APPARATUS FOR HANDLING MATTE AND SLAG OF COPPER BLAST-FURNACES.—No. 906,622. George K. Fischer, New Rochelle, New York.



A system of the kind set forth, having a means for separating slag and matte, a working floor contiguous thereto, a tunnel arranged beneath said floor and adapted to receive a plurality of slag receptacles side by side, said receptacles mounted to be moved through said tunnel and said floor having an opening to the tunnel, and means for delivering slag from the separator through the opening and to either of the receptacles.

ORE-SEPARATOR.—No. 906,535. John G. Kirksey, Carthage, Missouri.



The combination with an inclined table having a flat uninterrupted upper surface; of a plurality of similar riffles secured upon and disposed entirely above the upper surface of the table, said riffles being inclined upwardly toward the discharge end of the table and each riffle comprising a flat elongated strip gradually increasing in thickness toward one end, the side edges of the strip being straight from end to end and perpendicular to the faces thereof, the upper and lower faces of the riffle being duplicates, said riffles forming grooves therebetween, the top of the table constituting the bottom of the grooves.

COMPANY REPORTS.

PHELPS, DODGE & CO.

This corporation controls the Copper Queen Consolidated Mining Co., the Moctezuma Copper Co., the Detroit Copper Mining Co., of Arizona, and the Stag Canon Fuel Co. In order to get these stocks listed on the New York and Boston Stock Exchanges, it was found advisable to form a corporation (with a capital of $50,000,000) by which the properties of the foregoing four companies might be held under one name. The majority of the stock of each of the companies is held by Arthur C. James, Cleveland, H. Dodge, James McLean, James Douglas, and their families.

In the consolidation the Copper Queen is valued at $27,000,000. It is paying $17 per share on 200,000 shares. In 1907 this mine produced 63,341,055 lb. copper and earned $4,471,137. The property covers 135 mining claims at Bisbee, Arizona, and a large portion of the ground is as yet undeveloped. The smelter, at Douglas, has a capacity of 3000 tons per day. The company does custom smelting and conducts a general mercantile business, with stores at Bisbee, Douglas, and Naco.

The Moctezuma property consists of 2500 acres of mineral ground in Sonora, Mexico. The chief mine is called the Pilares. An orebody 1700 by 1200 ft. has been proved down to 700 ft. A narrow-gauge railroad, 5 miles long, connects the mine with the concentrating mill at Nacozari. This mill has a capacity of 2000 tons per day. In 1907 the production of copper was 9,640,390 lb. and the net earnings $833,236. A production of 2,000,000 lb. copper per month can now be maintained.

The Detroit mines are in the Clifton district, Arizona, where the company owns 145 mining claims, yielding 36,000 tons per month of 3% copper ore. This is concentrated to 15% and smelted at the Morenci smelter, also owned by the company. In 1907 the production was 17,974,581 lb. copper and the earnings $814,874.

BUNKER HILL & SULLIVAN.

The full name is the Bunker Hill and Sullivan Mining and Concentrating Company. The Bunker Hill mine was originally consolidated with the Sullivan, and other claims have been added until the company owns 3000 acres. The mines are above the town of Wardner, in the Couer d'Alene region, Idaho. The office and mill are at Kellogg, two miles below Wardner. The latest report is for the fiscal year ending May 31, 1908. During this period the mine produced 330,730 tons of concentrating ore, at a cost of $511,288, so that the cost of mining was $1.548. The mine also produced 4340 tons of crude ore, which was shipped to the smelters, and the cost of mining this ore was $1.954 per ton. At the mill 330,930 tons were concentrated at a cost of 37.2 cents per ton and 72,468 tons of concentrate and middling were shipped, besides 4304 tons of crude ore, making the total shipments 76,773 tons. Thus the total expenses were $731,020, or $2.18 per ton of crude ore. The total receipts from shipments of concentrate and crude ore were $3,391,426, from which are deducted the freight and treatment charges, aggregating $1,351,654, leaving $2,039,771, from which the operating costs of $731,020 are subtracted, leaving an operating profit of $1,308,751. The average value obtained for lead was 3.995c. per pound, and for silver, 60.07c. per ounce. Dividends to the amount of $1,380,000 were paid.

CONIAGAS.

This silver mine is at Cobalt, Ontario. The name originates from compounding the chemical symbols of the metallic elements cobalt, nickel, silver, and arsenic, all of which exist in the ore. The total silver produced in the year ending October 31, 1908, was 1,444,229 oz. at an average price of 52.3c., as compared to 67.05c. last year. The ore reserves are estimated to contain 13,000,000 oz. silver. The yield comes from picked ore, which is sold to smelters, and concentrating ore, of which 14,064 tons yielded 297 tons of concentrate. The total receipts for the year were $727,195, on which the operating profit was $501,718. The dividends absorbed $440,000.

ASHANTI GOLDFIELDS, WEST AFRICA.

The tonnage treated at this mine for the year ending June 30, 1908, was 59,150, from which, together with that from other trifling sources, 40,825 oz. gold, and 3985 oz. silver was extracted. The profit realized was £80,942. After the usual provision for depreciation and development, and writing off £15,000 from shares in the Sansu mine, a net profit of £34,646 was obtained. The directors decided to write off out of profit and loss account the balance of expenditure on the main shafts and development, amounting to £57,008, leaving a credit balance of £4752. The development work has revealed ore-reserves available for stoping of 135,000 tons, leaving an average gold tenor of 14.6 dwt. Indicated ore increases this by 80,000 tons in the Justice mine, estimated to carry 12 dwt. gold. Thus the mine is more than 2 years ahead of the existing milling capacity. The old stamp-mill and cyanide plant has been found unsuited to the ore from the new Justice mine, and a system of sliming and filter-pressing will be resorted to, the plant for this purpose to have a capacity of 2000 tons per month. The equipment will be in operation in January of this year. This plant will be duplicated during the year; a four-unit roasting plant will be added, a central electric station will be installed, and a more comprehensive scheme of power centralization will be placed in service as a means of economizing fuel.

PIONEER MINING.

According to the annual report of Jafet Lindeberg, the president and general manager of the Pioneer Mining Co., of Seattle, the gross output of gold for the year ending on October 10, 1908, was $974,310. The net profits were $571,903. Out of the profits the company spent $120,000 in purchase of new property. A dividend of 3%, absorbing $150,000, was paid on November 16. Prospects for the next season are excellent and the output, barring labor troubles, is expected to reach $800,000 easily. The company owns a large area of placer ground near Nome, Alaska, and handsome profits for several years are anticipated.

KALGURLI GOLD MINES, WESTERN AUSTRALIA.

This mine produced 127,008 tons of ore during the year ending July 31, 1908, from which a recovery was made averaging £2 16s. 0.48d. per ton. The tailing averaged 3s. 7.83d. per ton. The costs for mining were 8s. 5.11d. and for treatment 12s. 3.39d. per ton. Dividends amounting to £180,000 were paid, bringing the total profit-division to date, since 1901-2, to £720,000, which is equivalent to £6 per share. This has been realized from a total of 585,375 tons of ore. The ore during the year was derived from all parts of the mine, from the surface down to the 1350-ft. level, the heaviest production coming from the zone between 750 and 1000 ft. Development likewise has been continued throughout the mine, discoveries of importance being made within 255 ft. of the main shaft on the surface. The manager, R. S. Black, reports estimated ore reserves of 510,000 tons above the 1350-ft. level. The orebodies are erratic, and the grade extremely so, causing definite measurement and valuation to be difficult, without performing an amount of development work that would entail expenses out of proportion to the tonnage made ready for stoping. The manager says: "Under the system of working, an average of 55s. (per ton) has been maintained. Had I found that this grade necessitated the undue depletion of the richer ore I would have lowered it, as I shall at any time do if there is necessity for it." Ore was not developed at any deeper level than during the previous year, so that the addition to the ore reserves has not kept pace with the extraction, and the available tonnage shows considerable diminution. As will be seen, however, the management has prudently kept development so far ahead of mill-requirements that there is a 4-year supply on hand, giving ample time for extensive exploration of the deposit. Details of mining and milling costs are not given in the report.

A Successful Tramway.

By Don Maguire.

Among difficult feats of tramway building in Utah may be mentioned the aerial wire-rope tramway completed during the early part of August 1908 by the Broderick & Bascom Rope Co., of St. Louis, for the Napoleon & Maghera Copper Mining & Reduction Co., of Ogden, Utah.

The property it situated on the Sierra Madre mountain, in Box Elder county, Utah. This is one of the steepest and highest portions of the Wasatch range. The district produces gold, silver, copper, and lead ores; the lodes occupy fissures in the granite. The most productive mines are the Eldorado, Napoleon & Maghera, Santa Maria, and the Prince of India. The Napoleon & Maghera property, on which the tramway has been built, covers five large lodes, four of which yield copper ore containing gold and silver. The copper veins are situated in the western part of the property



The Napoleon & Maghera Tram.

in a locality difficult of access, so that during three years all supplies were furnished to the several mine openings by means of a burro train that traveled over an almost inaccesible trail.

The distance from the mill-site, at the base of the mountain, to the mouth of the principal adit is approximately 2632 ft. The contour over this distance is rough beyond description, and many mining experts were of the opinion that it was not practical to install an aerial tramway, but Broderick & Bascom undertook the contract and have installed a plant that is a success in every respect. The tramway engineer began work in September 1907. An immense volume of rock had to be blasted from the sides of the steep granite cliffs in order to secure a footing for the towers; at other places, foundations of masonry were necessary for the same purpose; near the upper terminal, or loading station, a gap had to be mined and blasted out of the sharp ridge that separated the mouth of the adit from the crooked canyon, down which the ore is transported to the mill over the tramway. From August until December the work was pushed vigorously; inclement weather and heavy snow-storms intervening, work on the tramway was discontinued, but a small force of men took a contract to deliver a large lot of heavy timbers required for the terminals, ore-bins, and other purposes; these timbers were passed over the cliffs by means of block and tackle, cables, and horse-power. After three months of laborious work the last of the timbers and machinery were transported to their proper place and early in June 1908 Broderick & Bascom's engineer returned to complete the work that was discontinued in December 1907. With a force of 12 men the engineer continued the construction, and on the evening of August 14 the tramway was completed and operated successfully. The present capacity of the tramway is 300 tons every 10 hours. This can be doubled by increasing the number of buckets. In no part of the Rocky Mountain country is there a tramway that works more smoothly.

Commercial Paragraphs.

The Coahuila Mining & Smelting Co., Ltd., of Viesca, Coahuila, Mexico, will be interested in receiving descriptive literature on pneumatic ore-separating machinery.

The testing plant of the Elspass Engineering Co. and L. S. Pierce has been moved to the rear of 1625 Champa St., Denver, Colo. The offices of the above firms are at 1650 Champa street.

The Chicago House Wrecking Co. has sent us copies of testimonial letters attesting the satisfaction they have given customers in widely scattered districts of the United Sates with large shipments of lumber, building material, and other merchandise.

The Economic Machinery Co., Denver, Colo., manufacturer of the Deitz Airolectric rock-drill and the Fairchild automatic vacuum-filter, is building eight of the Deitz Airolectric rock-drills for the Crystal River Marble Co., of Gunnison county, Colorado.

Wm. Ainsworth & Sons state that they have received an order for three 18-in. precision wye levels and two 5-in. precision transits from the Aqueduct Commission in charge of the construction of the Los Angeles Aqueduct, awarded chiefly on account of the interchangeability of parts, rigidity, and workmanship.

The Triplex Roll Co., Denver, has been incorporated for $350,000, with J. H. Elspass, Henry Eggers, and Mary L. Jacobs as incorporators. It is the owner of the patents of the Triplex rolls, which have been in use in different mills throughout the country for the past two or three years. Their catalogue is now ready for distribution.

The Foos Gas Engine Co., of Springfield, Ohio, is furnishing a producer-gas plant to the Standard Optical Co., at Geneva, N. Y. The engine will be a 100-hp. three-cylinder Foos vertical, from which power will be transmitted by rope drive. The producer will use Pennsylvania anthracite, and is so arranged that a portion of the gas will be drawn off and used for annealing furnaces. The plant will contribute materially to the economical operation of the factory.

Catalogues Received.

The Thos. H. Dallett Co., Philadelphia, is distributing its catalogue No. 100, describing air-compressors.

The Jeffrey Mfg. Co., Columbus, Ohio, has just issued a catalogue, No. 67D, on its line of Century rubber belt conveyors.

The Taylor Iron & Steel Co., High Bridge, N. J., is distributing a handsome pamphlet on 'Tisco Manganese Steel for Crusher Plants'.

John V. N. Dorr, Denver, has published an attractive booklet describing and discussing the advantages of the Dorr classifier and Dorr continuous slime thickener.

The Robins New Conveyor Co., Chicago, will send, upon request, a copy of its Bulletin No. 1, which is a re-print of a paper read by C. Kemble Baldwin, on 'The Belt Conveyor' before the American Society of Mechanical Engineers.

The American Blower Co., Detroit, Mich., has recently issued new publications as follows: Catalogue 244, on variable speed engines; Catalogue 247, on steam traps; Circular 242, on electric forge blowers; and Circular 246, on shop heating.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING PARTNERSHIP.

Two persons, under a lease of mining property, agreed to work the property jointly, each to bear one half the expense. Where one put in his own work and the other furnished a third person to do his share of the work, they were engaged in a joint enterprise for the purpose of carrying out the provision of the lease and were equal partners. A mining partnership exists where the several owners of a mine co-operate in working it.

Walker *v.* Bruse, (Colo.) 97 Pac. 250, July, '08.

LIEN ON MINING PARTNERSHIP PROPERTY.

Partners operating oil leases have a lien on the firm property for advances made by them in payment of the firm debts; but no such lien exists as against the product of oil wells which have been divided. The lien remains valid as against any property used by the firm in operating the leasehold.

Greenlee *v.* Steel Smith, (W. Va.) 62 Southeast. 459, Sept., '08.

STATUTES REGULATING MINES—CONSTRUCTION.

Statutes requiring coal corporations to always keep on hand near the mine, stretchers, bandages, medicines, etc., for use in case of injury to the workmen, are in derogation of the common law, highly penal in character, and should be strictly construed.

Sourwine *v.* McRoy Clay Works, (Ind. App.) 85 Northeast. 782, Oct., '08.

CONDEMNATION OF RIGHT OF WAY.

A case of peculiar interest to mining companies has recently been decided by the Supreme Court of Tennessee. It appars that the Alford Phosphate Co. owns 300 acres of phosphate lands, estimated to contain 500,000 tons of phosphate rock. It also appears that the Duck River Phosphate Co. owns large phosphate mines in the same vicinity, and that the latter company owned and operated a private railroad from its mines, a distance of nearly 5 miles, connecting with the Nashville, Chattanooga & St. Louis railway. This private road for a distance of about 2 miles is built along the banks of Duck river and at the base of a bluff or cliff 30 or 40 ft. high. Owing to the peculiar contour of the country, there was no other practical place for another railroad, from the mines of the Alford Phophate Co.; this company, desiring an outlet for its products, attempted to condemn the right of way and the tracks of the Duck River Phosphate Co. for a distance of 2 miles where it ran along the river bank and under such bluff, to use in connection with a private railroad used and operated by the Alford Phosphate Co. It was decided by the Court that the right cannot be conferred upon either a public or private corporation to condemn property for private use; and that if the condemnation was for a public use, the right of way and tracks of an existing private railroad could not be condemned without condemning the entire road. And the Court held invalid an act of the Legislature which gave a phophate company the right to condemn property for a railroad, and that a provision of such act declaring property condemned by such a corporation a public road could not change the character of its use; and that the act was invalid as authorizing the condemnation of property for private purposes.

Note.—This decision of the Tennessee court in no way conflicts with or destroys the right of one public railroad in mountainous districts, under a United States statute, as well as under statutes of some States, from condemning, longitudinally, the tracks and right of way of another railroad through gorges or chasms or on mountain sides, where there is only room for one track.

Alford Phosphate Co. *v* Duck River Phosphate Co., (Tenn.) 113 Southwest. 410, July, '08.

Publications Received.

Any of the books noticed in these columns are for sale by or can be procured from the MINING AND SCIENTIFIC PRESS.

SMITHSONIAN INSTITUTION: ANNUAL REPORT OF THE BOARD OF REGENTS FOR 1907. Washington. Government Printing Office. 1908.

The annual report of the Smithsonian Institution contains satisfaction for a wide range of scientific appetites. Most of the contributions have an economic leaning, as for example the notable paper on the 'Steam Turbine' by Charles A. Parsons; on 'Mechanical Composition in Printing' by A. Turpain; the timely discussion on 'Electric Trunk-Line Operation' by Frank J. Sprague; and another on 'Electric Wave Telegraphy' by J. A. Fleming. The 'Properties and Natures of Electric Radiations', having power to ionize gases, to effect photographic plates, and to excite phosphorescence, are discussed by W. H. Bragg. A review of the present status of 'Electro-Metallurgy' is given by John B. C. Kershaw, and Thomas W. Smillie contributes an account of the 'Recent Progress in Color Photography'. As a matter of antiquarian interest, Adrien de Mortillet, president of the Société Préhistorique de France, shows that the manufacture of bronze was known to the pre-Colombian inhabitants of the Andean plateau.

To geologists, and students of ore deposits, the paper of leading interest will be the 'Geology of the Inner Earth' by J. W. Gregory. The argument favoring the planetismal, advanced by Chamberlin, theory is weightily summed, and the lack of demonstration of the existance of a barysphere is made plain. A comparison of the density of the earth with that of meteorites calls attention to a resemblance that is striking. Strutt's estimate of a uniform temperature of 1500° C. for the interior of the earth within a 45-mile exterior envelope, is brought into prominence, as conforming to other conceptions of the state of the earth necessitated by recent investigations. The segregation of ores by osmotic pressure from basic magmas is on the whole controverted. Other notable papers are on the 'Salton Sea', 'Inland Waterways', and the 'Present Position of Paleozoic Botany'.

WATER POWER ENGINEERINGS The Theory, Investigation, and Development of Water Powers. By Daniel W. Mead. 8vo.; 787 pp.; index; ill. McGraw Publishing Co., New York. 1908. Price $6.

As a practical handbook this volume is to be recommended. Mr. Mead possesses the true educator's faculty of simplifying his subject; he develops the mathematical side without involving it in obscurity. In fact, assumption of familiarity with the fundamentals is not made; the author starts in every case with first principles, leading with clear exposition to the abstruse problems. In this regard the work is unusual. It is in the highest sense a guide to the correct statement and solution of the problems arising in the development of water power. After introductory chapters on power and hydraulics, catchment areas, rainfall, disposal of rainfall, run-off, measurement of streams, follow discussion of water-wheels, hydraulics of the turbine, selecting and testing turbines, the load-curve and load-factors, speed-regulation, governors, design of plant, examples of water-power plants, and so on, including cost, value, and sale of power. A valuable feature consists in the elaborate bibliography which is appended to each chapter.

A STUDY OF ORE DEPOSITS FOR THE PRACTICAL MINER. By J. P. Wallace. 8vo., 340 pp., Ill., Index. Hill Publishing Co., New York. Price $3.

The ECK DYNAMO & MOTOR CO., Belleville, N. J., is issuing a series of bulletins describing its product. A useful feature of these bulletins is one or two pages on which is given data to aid in the selection and installation of the apparatus. Another notable feature is the fact that the dimensions of the different types are given in great detail.

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EDITORIAL.

LOS ANGELES will soon receive deserved recognition as a mining base by the establishment of a United States assay office. The bill which has passed the Senate carries an appropriation of $20,000 for annual expenses of maintenance.

THE AMERICAN Institute of Mining Engineers will meet at New Haven on February 23. A number of interesting papers are announced, including one on 'A Sea-Level Canal at Panama', a communication to which much publicity has already been accorded. It should provoke an interesting discussion.

THE CANADIAN Mining Institute meets in eleventh annual session at Montreal on March 3, 4, and 5. The proceedings promise to be interesting, many papers being on the program, including addresses from Messrs. James F. Kemp, Heinrich Ries, F. Cirkel, S. S. Fowler, H. E. T. Haultain, A. C. Lane, J. C. Murray, and George R. Smith.

SO MUCH good work has been done in Alaska by the Geological Survey that we venture to make a suggestion: Every summer prospectors wander across the wilderness of the interior, and up the many shallow rivers, in search of gold. These men test the creeks and obtain information as to the character of the gravel, the depth to bedrock, and other facts of practical value, all of which are lost. Parties of men will penetrate laboriously into a supposedly new district only to find evidence of previous prospecting. Would it not be possible to collect information from these nomadic diggers, for instance, at a junction point, like Fort Gibbon, where so many trails meet? An intelligent young man stationed there during the summer could, we believe, place on record a large amount of information gathered from wayfarers and likely to be useful to other prospectors.

DISCRIMINATIONS by the railroads assume varying forms under the restrictions imposed by Government prosecution. The favorites continue to be favored, which necessarily means participation by individual railroad officials in the benefits conferred nominally upon outsiders. The prevailing ruse is to farm out a portion of the common carriers' duties to shippers, among whom the evils flowing from private ownership of freight cars are more difficult to overcome. The allowances made from haulage charges in consideration of the shipper supplying rolling stock prevent competition by less fortunate rivals. In private elevators, lighters, and the like, are also found convenient means for disguising rebates that embarrass shippers who will not share

their profits with the railroads. Manifestly the transportation companies must be compelled to perform similar duties at uniform rates for all.

TENDENCIES to check monopoly by resort to the leasehold system instead of surrendering national resources in fee simple to individuals are steadily growing. The latest example is the proposal to lease phosphate lands. By executive order phosphate deposits on public lands were recently withdrawn from location. The passage of the bill now introduced into Congress would permit the utilization of phosphate deposits, thus creating a larger demand for sulphuric acid, the ultimate result benefiting both smelter and farmer. A feature of the bill prohibiting the exportation of phosphate is most commendable.

LEGISLATION to protect mining investors is becoming popular. The legislature of the State of Washington is being urged to pass new laws and the Governor in his biennial message makes the following recommendations:

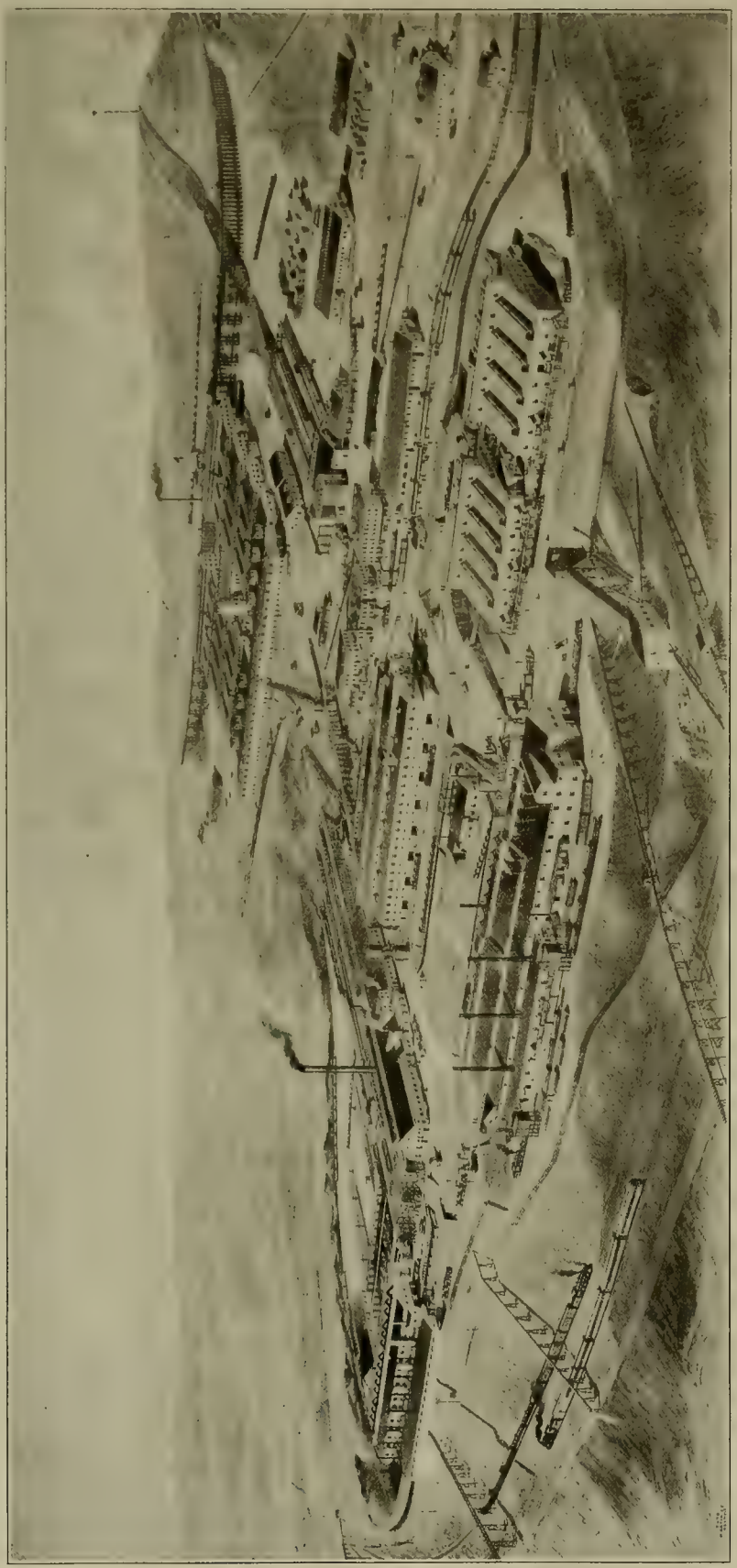
"Incorporations based upon unpatented claims should be declared illegal, since such holdings may lapse at any time; or else the board of directors of such corporations should be made personally liable for all debts contracted until the claims are patented at the expense of the promoters; no transfer of promoters' stock should be permitted until all of the treasury stock has been disposed of; all moneys derived from the sale of treasury stock should be placed in escrow until at least one-half of the treasury stock has been sold for cash, and unless such an amount is sold within a certain time—say six months—all such moneys should be returned intact to the subscribers, and such other provisions should be incorporated as will adequately safeguard the interests of investors."

Some of these provisions are excellent. Any enactments that will stop bad practices without injuring legitimate business should receive the support of earnest citizens.

FROM the latest circular issued from the office of the Secretary of the American Institute of Mining Engineers, we note with interest the nominations for officers this year: for president, Mr. David W. Brunton is named, and no man is better fitted to be titular head of the profession of mining engineering in America; for vice-presidents, Messrs. H. V. Winchell, W. L. Saunders, and W. C. Ralston are nominated. Two of these three are obviously excellent selections, but against the third we deem it proper to protest. Before performing an ungracious duty we beg to state that no criticism is implied upon our fellow townsman, Mr. W. C. Ralston, who probably was not consulted as to his nomination, and if we find ourselves in the difficult position of criticizing the management of the Institute, it is a task not performed with any eagerness, for we yield to none in our respect for Dr. Raymond and in appreciation of his services to the Institute in particular, and to the American mining industry in general. After all, the American Institute of Mining Engineers has a name as a national organization of professional men, even though a large fraction of the membership may come more nearly under that vague designation of 'mining men,' that is, persons having an interest in the industry of mining, whether as shareholders, promoters, brokers, or journalists. Some of these are not even first cousins to a mining engineer, but they are worthy people and they derive much benefit from the association—to which they are welcome. But as long as the Institute is to be a society of mining engineers, the chiefs ought to be mining engineers also, always presuming that the men so selected are intended to be representative. Now, Mr. Ralston is a politician and a broker, not a mining engineer. As politician, he has been an effective State senator; as broker, his name appears in each issue of this journal on the page devoted to the mining market. We can readily believe that the good people in New York may have assumed that Mr. Ralston was a mining engineer because he is, or was, president of the California Miners' Association, but that assumption has a touch of humor. The gentleman was also in charge of mines at one time and then indeed he was a mining engineer, for a mining engineer is a man doing the work of a mining engineer. Whether he does it efficiently or inefficiently does not enter into the definition. Mr. Ralston is not *now* a mining engineer; he is a mining broker. That suffices. Finally, we are in a position to state the simple fact that Mr. Ralston depreciates and repudiates the mining engineer as a guide to the development and operation of mines. Moreover, if the American Institute is to stand for anything, it should have officers that stand for something. By what process, and by whom, was Mr. Ralston nominated?

The Washoe Decision.

On January 25 Judge Hunt, of the United States District Court, at Helena, Montana, handed down a decision denying the application of the farmers in the Deerlodge valley for the closure of the Washoe smelter. The Judge concludes that the loss to the general community arising from the closing of the smelting plant would be much greater than that sustained by the individuals making the complaint. He asks for further evidence in regard to mitigation of the nuisance due to fume, and he desires to be fully advised in regard thereto before making final disposition of the case. We rejoice in this decision and congratulate, first of all, the able technical men in charge of this great reduction works and, after them, the copper mining company which controls the Washoe plant. We also congratulate the people of Montana in being saved from a great blow to its basic industry, for a decision compelling the closing of the Washoe smelter would have been tantamount to a sentence of outlawry upon the metallurgical operations necessary to the extraction of copper from the ore deposits of the Butte district. It is high time that the public realized how far an unreasoning sentiment has been permitted to aid schemes of



The Washoe Concentrator and Smelter, Anaconda, Montana.

spoliation and blackmail. We have good reason to believe that the smelting companies are now fully awake to the danger of disregarding the public interest by carelessness in choosing smelter sites and reckless emission of fumes injurious to stock and to agriculture; every effort is being made to avoid infliction of injury, and if a similar solicitude had been evinced ten years ago, they would have been spared the unpleasant experience and the costly litigation that has crippled smelting operations in Utah, in California, and in Montana. We note with particular satisfaction that the decision in the Washoe case is based on equity. Before smelting was started at Anaconda there was no farming in the Deerlodge valley, only stock-raising; the smelter, and the mines contributory to it, created the local market for agricultural products, and stimulated the tilling of the ground. The campaign against the Anaconda company was due, in the first instance, to the effects of smoke distributed broadcast from a low chimney, which has since been replaced by a tall stack, so placed as to minimize harm by diluting the smoke. If the smelter, and with it the mines, were shut-down, the farms would become valueless. Widening the prospect, we find that not only the people of the Deerlodge valley, but the entire community living in the neighboring town of Butte would be deprived of a living should smelting, and with it mining, be stopped. Thus the decision is based on the greatest good to the greater number, and while it does not absolve the smelter management from every effort to mitigate a nuisance, it does place them in a position where they should be considered, industrially, not as enemies but as benefactors of the community.

Earthquake Forecasts.

In this issue we publish, by courtesy of the editor of *Science*, a lengthy abstract from an address on the above subject by the veteran geologist, Mr. G. K. Gilbert. No one is better qualified to offer an authoritative résumé of the tentative efforts to give a humanitarian value to the study of earthquakes. The test of a science is prediction; to that test seismology submits in a shamefaced manner, as one who has accomplished little but promises to do better if given an opportunity. Indeed, there is ample warrant for the sarcastic comment recently offered by Mr. T. A. Jaggar in *The Nation*, where he imagines an inhabitant of Mars, fresh from Professor Lowell's canals, dropping upon this planet and enquiring into the methods of earth study. The Martian is informed that we do many things skilfully; we weigh the stars and we foretell the movements of suns whose light has taken longer to reach us than the whole period of man's existence; at this our celestial visitor marvels greatly, but he is perplexed to learn that the earth-beings have failed to know and understand their terrestrial home, they have been so busy examining the heavenly roof of their habitation that they overlook the floor on which they stand. In truth, there is room for satire. Even our infant science of geology is so fully occupied in unraveling the history of the past that it has failed utterly in predicting the activities of the future as they affect man. Only Italy and Japan have made a serious and systematic study of the dread unrest the expression of which is the terror that comes by night and the horror that darkens the day. The Japanese, living in a region particularly subject to earth tremors, have contributed fully a half of the real knowledge extant concerning earthquakes. It is time to take the matter seriously; no part of the earth's surface is absolutely immune from the danger, and while modern engineering has enabled man to build more strongly, the complexities of civilized life have added greatly to the horrors of the earthquake. When men lived under trees or in tents, the vibration of the ground might drive them mad, the rift in the surface might bury them, but they were spared the fire, the pestilence, and the manifold injuries due to falling walls, electric wires, burning gas, destruction of property, and unhinging of business. Man living in the state of nature suffered little from earthquakes such as worked untold harm to San Francisco, Valparaiso, Kingston, and Messina. Geologic evidence shows that in the remote past many portions of the earth's surface have been traversed by rifts causing a shifting of rocks accompanied by disturbances such as would have erased human beings anywhere near the line of movement, earthquakes as much severer than those recorded in written history as a railroad collision is more violent than the jostling of one man against another in a crowd. And yet the toll of human life during recent years has been terrible. Since January 1901 not less than 300,000 persons have been killed, that is, an average of 100 per day. It seems worth while to found a few chairs of seismology and endow a few observatories to study earth movements. Such an expenditure of money and brain-tissue is demanded in the interest of humanity. Nor would it be fruitless. There is hope of results. Mr. Gilbert cites several examples of forecasts made by scientific observers; to those quoted by him we may add the prediction by Mr. Frank A. Perret, an American vulcanologist, who nearly two years ago foretold the disaster in southern Italy. In November 1907 he stated in the *World's Work* that a great eruption of Mt. Etna was impending, and it is a fact that the Messina disaster came on the earthquake date, expressed by Mr. Perret as the "terrestrial maximum of gravitational stress," which was platted by him in his diagrams for 1908. This young American investigator devotes all his time to the special study of volcanoes and earthquakes, in a manner analogous to Pasteur's devotion to the study of bacteria. A few friends have contributed the funds necessary for Mr. Perret's investigations. Similar aid, but on a much larger scale, ought to be given by the governments of enlightened nations. The work requires observatories at many points, it needs delicate instruments and the preparation of detailed records; the large patience of the scientific enquirer and the intelligent persistence of the seeker after truth are wanted; but first money. Japan has led the way: the people deemed barbarians by the scum of Europe are the only nation that has tried systematically to study the phenomena that undermine the life of man.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

CHARLES W. MERRILL is at New York.

DUNCAN MCVICHIE was at Tonopah lately.

H. W. TURNER is examining mines in Nevada.

CARNEY HARTLEY is examining mines in New Mexico.

MAX JUNGHANDEL, of Tonopah, is now at the Fairmont hotel.

E. S. PETTIS is with the Soledad Mining Co., at Mohave, California.

WILLIAM N. CUMMINGS, of Tucson, was in San Francisco for a few days.

A. D. GASSAWAY has left Berkeley for London, on his way to Siberia.

PHILIP WISEMAN is manager of the Ray copper mine, at Kelvin, Arizona.

A. B. ROGERS is superintendent of the North Star mine at Kofa, Arizona.

E. N. SKINNER is now advisory mining engineer to Trippe, Thompson & Company.

E. M. ROGERS is consulting engineer to the Golden Star Mines Co., at Kofa, Arizona.

R. B. HEGARDT is general manager for the Old Dominion Copper Co. at Globe, Arizona.

JOHN HAYS HAMMOND has been re-elected president of the Rocky Mountain Club, New York.

J. D. HUBBARD has been appointed metallurgist to the Oriental Consolidated, at Unsan, Korea.

ARTHUR LAKES has returned from California and has opened an office at 221 McPhee Bdg., Denver.

WILLIAM L. ROBERTSON, mill superintendent to the Montana Mining Co., is spending the winter at Salt Lake.

A. A. THOMSON is on his way from London to Kansanshi, in northern Rhodesia, in the service of the Tanganyika Concessions.

ARTHUR LAKES JR. has opened an office at 222 McPhee Bdg., Denver, and will make a specialty of placer mining and dredging.

C. G. PATTERSON has returned to San Francisco from Goldfield, where he has supervised the installation made by the Butters company at the mill of the Goldfield Consolidated Mining & Milling Company.

The next meeting of the Pacific Coast division of the Mining & Metallurgical Society of America is postponed from January 30 to February 13. The meeting and dinner will take place at the Pacific Union Club, those who are members of this club acting as hosts to those who are not. This meeting will be restricted to members of the Society who belong to the local division. It is expected that an important matter of policy will be decided.

Obituary.

THOMAS JONES died at the age of 74 from a stroke of apoplexy at his home in Neodesha, Kansas, on January 11. He began his career in the employ of Vivian & Sons., at Swansea, South Wales, and served with that firm for 15 years, after which he was associated with Siemens, assisting him in perfecting the open-hearth steel process, at Keinsdorf, Gratz, and Koenigshutte, in Germany. He then came to the United States and built a steel plant at Providence, Rhode Island. Later he became engaged in the zinc smelting business, and in this also he was one of the pioneers, building the first plants in Rhode Island, Virginia, Illinois, and Canada, the last mentioned being the works of the Canadian Metals Co., at Frank, Alberta, which was completed in 1907. He retired from active business a year ago, but still retained much of the strength and energy of a man in the prime of life. He leaves a wife and four sons, two of whom are engaged in mining.

Latest Market Reports.

LOCAL METAL PRICES—January 28.

Antimony	12@16c	Quicksilver (flask)	$44½@46½
Casting Copper (scrap)	8½@13½c	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33¼c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 21. £. s. d.	Jan. 28. £. s. d.	
Camp Bird	0 15 3	0 16 0	
El Oro	1 2 6	1 2 6	
Esperanza	3 3 0	3 1 0	ex div.
Dolores	1 10 0	1 10 0	
Oroville Dredging	0 7 9	0 9 9	ex div.
Mexico Mines	4 17 6	4 17 6	
Tomboy	0 18 9	0 18 9	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Jan. 22	13.62	4.17	5 12	51½
" 23	13.62	4 17	5.12	51½
" 24	Sunday.	No market.		
" 25	13.62	4 17	5.12	52
" 26	13.56	4.16	5.10	52⅜
" 27	13.56	4.16	5.10	51¾
" 28	13.56	4.16	5.10	51¾

SOUTHERN NEVADA STOCKS.

San Francisco, January 28.

Atlanta	$ 15	Laguna	
Belmont	85	MacNamara	31
Booth	23	Manhattan Con	5
Columbia Mtn	15	Midway	21
Combination Fraction	1.17	Montana Tonopah	75
Daisy	82	Nevada Hills	1.45
Fairview Eagle	25	Rawhide Queen	42
Florence	4.12	Sandstorm	15
Gold Bar (Bullfrog)	1	Silver Pick	10
Goldfield Con	7.80	St. Ives	17
Gold Kewenas	24	Tonopah Extension	45
Great Bend	20	Tonopah of Nevada	6.00
Jim Butler	16	Tramp Con	10
Jumbo Extension	18	West End	30

(By courtesy of W. C. Ralston, 353 Bush St.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Jan. 21.	Jan. 28.
Amalgamated Copper	79	75⅝
American Smelting & Refining Co	87⅛	84
Boston Copper	14⅝	14
Butte Coalition	24	23½
Cumberland Ely	8¾	8⅝
Dolores	7	7
El Rayo	33⅛	33¾
Giroux	8⅞	8¼
Greene-Cananea	11	10⅞
Indiana Sonora	4¾	4¾
La Rose	6½	6½
Miami Copper	13⅞	13
Nevada Consolidated	18½	18⅛
Newhouse	5¼	5⅛
Nipissing	10¼	9⅞
Ohio Copper	5¾	6⅝
Tennessee Copper	44½	44⅝
Utah Copper	44¼	44
Yukon	4⅛	4⅛

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. January 28.		Closing prices. January 28.
Adventure	8	Miami	13
Ahmeek		Mohawk	
Allouez	35	Nevada Con	18
Amalgamated	75¾	North Butte	76½
Arcadian	2½	Old Dominion	53¼
Atlantic	15	Osceola	128
Boston Con	14⅜	Parrot	27½
Butte Coalition	23½	Quincy	91
Calumet & Arizona	105	Rhode Island	4¾
Calumet & Hecla	635	Santa Fe	2¼
Centennial	30	Shannon	14¾
Copper Range	75¼	Tamarack	78
Daly-West	10	Trinity	15
Franklin	15	United Copper Con	13¾
Granby	102¾	Utah Copper	43
Greene-Cananea, ctf	10⅞	Victoria	4½
Isle Royale	24¼	Winona	5¼
Mass	5¼	Wolverine	145

General Mining News.

ARIZONA.

GILA COUNTY.

More detailed accounts of the recent strike made in the Gray mine of the United Globe, owned by the Old Dominion Copper Mining & Smelting Co., have come to hand. It was made in a winze below the 600-ft. level, 1000 ft. north of the Gray shaft, where 29 ft. of good sulphide was intersected by a cross-cut. It is reported that the whole 29 ft. of ore averages 5 to 6% copper. The same orebody has been opened on the 600-ft. level and to a less extent on the 700-ft. This discovery proves the existence of a big tonnage of ore.——On January 23, R. B. Hegardt, the superintendent of the Old Dominion Copper & Mining Co., posted a notice that the mines would be closed the next day and remain closed indefinitely. It was the first definite announcement of what had been feared for two or three days, following a controversy between the miners' union and the company as to the right of the walking delegate to visit the grounds. Every mine in the district, including the Miami, the Arizona Commercial, and the Globe Consolidated decided to support the Old Dominion in its position; and it was learned from reliable authority that the closing of the mines will be followed by the closing of the smelter in three or four days, when the supply of ore on hand will have been exhausted. It is locally believed that the presence in camp, and actions of one man alone is responsible for the shut-down that has paralyzed all business in Globe. This man is Albert Wills, walking delegate.

MOHAVE COUNTY.

The San Diego company which recently took over the Cruz mine near Yucca, has sent in supplies and expects to start work soon, sinking a shaft. Joe Kelsey and M. J. Ryan are watching the interests of the new owners.—— T. J. Grant, who is in charge of the work for the Stewart-Warner Co., at Music Mtn., expects to have the hoist in working order within 10 days. Sinking will then be started. Carl Holtschue, of Goldfield, Nevada, is making an examination of the mine for the company.——Eighty-four oil location notices were received from the north part of the county this week. The first of the year witnessed the re-location of all the oil lands in the oil district along the Virgin river, both in Utah and Mohave county.——Mrs. E. B. Smith, of Hermosa Beach, California, has been looking over her mining interests in this county. She is a part owner in the Golconda and Alpha mines, in the Wallapai district. The Golconda mine is under bond to the Union Basin Mining Co. and is showing up excellent bodies of ore.

PIMA COUNTY.

The Fresnal mines, in the Barbaquivari mountains, 75 miles from Tucson, have been sold to J. R. Clair and associates, of Orange, New Jersey, for $200,000. The property was located 10 years ago, but has been worked only recently. There is said to be a vein 75 ft. wide opened to the 270-ft. level, all of which it will pay to work. E. T. Jones is in charge of the development work now under way.

CALIFORNIA.

ELDORADO COUNTY.

At Georgia Slide, where the several mines have been continuously operated for over 50 years, it is a common occurrence to strike a bunch of rich gravel which yields thousands of dollars, and this is reported to have occurred quite recently.——Seymour Hill, J. F. Owen, and Albert Shafsky will immediately install a 2-stamp mill at the Independence mine, in which a $10,000 pocket was recently discovered. There is a small vein of rich quartz in the mine which they propose to take out and mill.—— Word comes from Greenwood creek to the effect that a company which has been developing a group of claims on Greenwood creek near the Rogers ranch, has struck several veins of ore which are rich in gold, silver, and copper.

INYO COUNTY.

T. G. Crawford, of the Cashier mine at Harrisburg, has been working hard for the past two years to develop his property. Both by adit and shaft, orebodies have been met with, and Crawford is arranging for the construction of a mill. Eastern people agreed to put up a 10-stamp mill, provided Crawford could supply the requisite water-supply. This he has accomplished by purchasing from Warnebeck, of Ballarat, the water rights they held in Jail canyon, which gives a flow of eight miner's inches—more than sufficient for 10 stamps. He has arranged for this flow to come through the 10-in. pipe belonging to the Skidoo Mines Co., as their pipe passes through Harrisburg.

NEVADA COUNTY.

(Special Correspondence).—A rich shoot of ore was recently encountered near the 1000-ft. level in the Empire mine. The company has placed orders with a local foundry for two large plunger pumps. As soon as these have been installed sinking will be resumed.——A small force of men are working at the Midas. Some fair-grade ore is being developed.——Operations at the Hill mine have been abandoned for the winter owing to the large quantity of water encountered.——Operations at the Murchie mine have been suspended for an indefinite period.——Considerable work is going on at the Grover & Murphy property. A 2-compartment shaft is being sunk to cut an extension of the Mountaineer vein-system. The hoisting and pumping plant has been completed. Harry B. Gray is superintendent.——The Blue Lead gravel mine at Relief Hill has been bonded to James Graham, of Modesto, and J. V. Snyder, of Nevada City. It is intended to commence work at once.——District Attorney Ford has issued notice that all old shafts must be made secure in accordance with the law. Little attention has hitherto been paid to this matter here.——Within a few days a 200-gal. 2-step turbine pump will be installed at the Golden Gate mine. It will be operated by a 20-hp. electric motor.——Cross-cutting is progressing steadily at the LeDuc mine. It is expected to cut the vein within 300 ft. One shift is employed.——The Gold Flat, Pittsburg, Potosi and extensions of the Gold Flat and Pittsburg, have been consolidated and taken over by a company known as the Pittsburg Gold Flat Mines Co. The consolidation covers 107 acres of patented mineral land. All of these properties are well developed, and arrangements are being perfected by Mark B. Kerr, the manager, to begin work on a large scale.

Grass Valley, January 25.

Every mine in the Grass Valley district has been much bothered by the long-continued rain storm; and especially those dependent on the electric current for pumping. For the voltage of the supply fell off, preventing the speeding up of the machinery to its full capacity. The water gained 100 ft. in the Idaho-Maryland mine, but the pumps are holding their own, and the manager anticipates no trouble, as all ore stoping is being done far above this level. At the Empire and North Star mines, men were laid off till the Colgate power plant was able to supply the full current, as all that came over the lines was required to keep the pumps running. Practically all the mines are at work again now, although the storm has been one of the fiercest for many years.

Tunis Young, vice-president of the Omega Placer Mining Co., has been making arrangements for the resumption of operations on the Omega gravel mine. Not much was done last year on account of a scarcity of water, but the recent heavy rains give assurance for an ample supply for the coming piping season. The mine is well equipped, with ample ditch capacity, and an electric plant for illumination. The restraining dam, on Scotchman's creek, retains a mile of storage ground. This summer a new outlet tunnel will be driven which will add another mile and a half of capacity for impounding the tailing.——The Blue Lead gravel mine has been bonded to James Graham, of Modesto, and James D. Snyder, of Nevada City. The present owners are not financially able to operate the property, and this is given as a reason for the deal now under way. The

Bloomfield ditch runs through the property, which contains about 670 acres. The channel is the same one that was worked in the Union mine adjoining the Blue Lead.

SAN BERNARDINO COUNTY.

A discovery of wulfenite, or lead molybdate, has recently been made by H. M. Benson and M. E. Stacey, near Nipton. The presence of this mineral nas been known for some time, and the original source continuously sought. During the first week after the vein was discovered 16 tons of the ore were extracted.

SHASTA COUNTY.

A deed has been recorded conveying the Rough and Ready mine from E. W. Brackett to the Minnie-Shasta Mining Co. The mine is four miles west of Reading.——R. H. Stevens, who has been assayer at the Mammonth for some time, has resigned to accept a similar position with the United States Smelting & Refining Co.'s plant at Bingham Junction, Utah.

SISKIYOU COUNTY.

With the setting in of the inclement weather the Mammoth Copper Mining Co., of Kennett, has called in its diamond-drilling crew that has been for two months engaged in prospecting the grounds adjoining the holdings of the Sisson Exploration & Mining Co. No conclusion can be drawn, however, as to what the Kennett people may contemplate doing later.

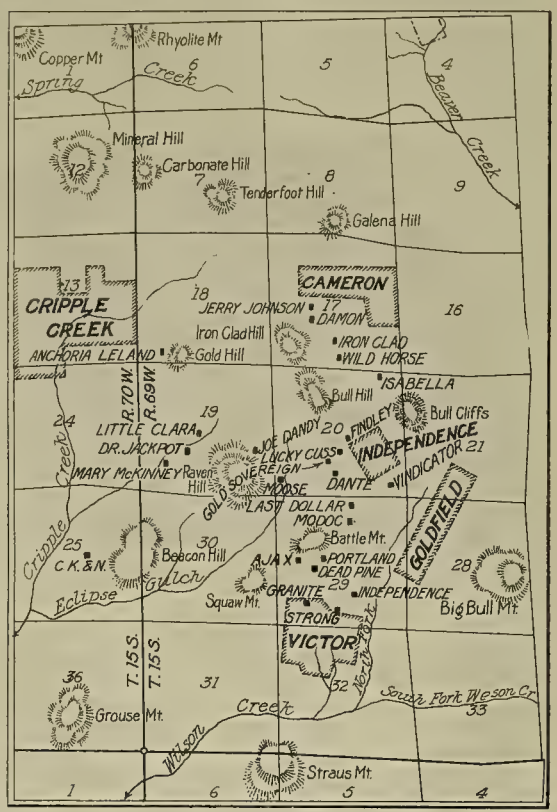
COLORADO.

CHAFFEE COUNTY.

Christopher Kirsch, a veteran miner, prospector, and merchant of Granite, states that he is preparing to erect a mill on the Young America property on Yankee Blade hill, which he has been working for several years. He has about 15,000 tons of $10 to $15 ore on the dump, none of which could be shipped, as the charges for hauling are too great.——The little mining town of Winfield, south of Leadville, is quite excited over the discovery there of a large streak of gold ore in the Banker tunnel. According to information received from Winfield, a 6-in. vein of high-grade has been discovered which assays 6 oz. gold, 280 oz. silver, 15% copper, and 10% lead.

CLEAR CREEK COUNTY.

(Special Correspondence).—The Waldorf Metals Co. has a force of men stoping the Wheeling vein, on a body of medium-grade ore which varies in width from 1 to 4 ft. Electric power is now being purchased and machine drills have been brought into use.——The Robert E. Lee adit on McClellan Mtn. has been driven over 600 ft. by F. Babcock, and should reach the Robert E. Lee vein within 150 ft. Oklahoma capitalists are financing the enterprise.——Work was resumed two weeks ago upon the Loop adit, the portal of which is situated near the high bridge of the C. & S. railway. The adit is in over 200 ft. and the South American vein will be reached within 300 ft. This vein yielded $75,000 from the old workings. N. Anderson is manager. ——H. Davenport has taken a lease on the third level of the Gold Dirt workings. A body of smelting ore has been exposed, from 18 in. to 2 ft. wide, and recent shipments netted returns of from 4 to 5 oz. gold per ton. There are 16 other sets of lessees at work on this property and heavy shipments are being sent out.——G. D. Parks, manager for the Crescent M. & L. Co., started the concentrating mill last week. This plant is situated below the dump of the New Boston mine and has been overhauled and remodeled. Tables and jigs have been installed, while electric power is being used to run the machinery. It is estimated that there is enough lead-zinc ore already developed to supply the mill for two years.——Work is being started on the Bellman mine, situated on Seaton Mtn. Operations will be carried on through the Newhouse adit.——A shipment of 26 tons of ore was made a few days ago from the Oxley lease at the Shafter mine and returns of 1.18 oz. gold and 10 oz. silver per ton were received. A streak of ore 20 in. wide is showing on the foot-wall, assaying 5 oz. gold per ton.——All the mills in the lower end of the county are running day and night. The Hudson plant is handling 100 tons of custom ore daily, and the manager, A. H. Roller, states that he has contracts that will insure the constant running of the mill during the year.——C. Hickman, who is leasing on the Little Mattie, is shipping an average of 60 tons of smelting ore each month that is worth from 2 to 3 oz. gold per ton.——The Sun and Moon, at Idaho Springs, is producing the heaviest tonnage of any mine in the district. From 4500 to 5000 tons of ore are being mined monthly, the greater part of the product being of milling grade. Contracts have been made with a number of mills for the treatment of the ore. R. C. Bonney is manager.——B. C. Catren is developing the Smuggler mine at Brown Mtn. Within another 30 days it is expected to have a crew of from 50 to 75 men at work. Driving east and west is to be started from the third, fourth, and fifth levels, while the shaft is to be sunk another 150 ft. Shipments of first-class ore are being made, worth about $90 per ton silver and lead. A large amount of lead-zinc ore on



Map of Cripple Creek District.

the dumps will be treated at the Terrible mill as soon as there is sufficient water flowing through the pipe line.—— The big Pelican mill, with a capacity of 250 tons per day, is to be started this week. The aerial tramway has been constructed to the old Pelican workings and the material on the dump is to be treated.

Georgetown, January 23.

GILPIN COUNTY.

Armfield & Co., who are working the Forks mine under lease from Senator H. M. Teller, are reported to have opened up a good-looking vein at a depth of about 250 ft., an assay of which showed $150 per ton in gold, silver, and lead.——Two carloads of smelting ore were shipped from the East Leavenworth mine in the Russell district to the Argo smelter last week. The property is being operated under a lease by Hancock & Co., who have a shaft down about 300 ft.——Henry Peeck, of Central City, secured a contract yesterday for the erection of a new shaft building 22 by 44 ft. in dimensions, and for the installation of a plant consisting of an 8 by 10 in. hoisting engine and a 50-hp. horizontal boiler at the Oro mine in Chase gulch. The

property is owned by Henry Bolthoff, of Denver, and is being worked under a lease by Manhire Bros., Gray Bros., John Park, and Stanley Harris, all of Central City.——There has been a report for several days past that the vein in the breast of the Newhouse tunnel is 11 or 12 ft. wide and that an assay of 17 oz. gold per ton has been obtained.

The Champion Mining & Milling Co. started its stamp-mill on North Beaver creek, and is handling ores from the Lone Star mine, where development has been kept up for some time. It is reported that the ore is amalgamating splendidly and a good clean-up may be expected. One shift is doing the work at present, but a night shift will shortly be put to work. About 15 lessees are at work on the Perigo property in the Independent district, and during the past week the mill was started on a 10-day run on ores taken from the different workings. Two cars of concentrate and one car of smelting ore are being shipped this week to the Argo plant. The improvements at the Smuggler mill in Moon gulch, consisting of a new engine and boiler, as well as additional tables for concentrating, are about completed. On account of the changes the mill has been shut-down for the past three weeks, but G. M. Ashmore, the manager, expects it to be running again very soon.

GUNNISON COUNTY.

Work has been resumed by the Ethel Gold Mining & Milling Co., in the Bowerman mining camp. The ore which it has uncovered gives hope that a mill may be erected when the snow clears away.

LAKE COUNTY.

The work of cutting the station at the 700-ft. level of the Helena shaft in Iowa gulch is now complete, and workmen are engaged in putting the new pump in position. It is expected that this will be completed during the present week, after which sinking will again be started.——There was more copper produced in the Leadville district in 1908 than in 1907, which at first seems paradoxical when the low price of that metal during last year is considered.

OURAY COUNTY.

The daily press announces that four men were killed and many had a narrow escape from death when an avalanche swept over the Camp Bird mine at Ouray, at a late hour on January 22.

SAN JUAN COUNTY.

It is understood that the Aspen mine will be re-opened at an early date and worked extensively. This is one of the Guggenheim properties, on Hazelton Mtn., near the Silver Lake mill. It is one of the old mines of the county and was a famous producer of the early days. The Aspen group embraces six or seven claims and is well developed. Two or three years ago the owners put the property in good condition. Now that the Silver Lake has closed down, that mill will be used to treat the Aspen ore. Morris Stockder will be in charge, as he has been for the past two years.

SUMMIT COUNTY.

Lennox & Giddings, of Colorado Springs, the owners of the Country Boy mine, have resumed work by driving an adit to cut the vein 200 ft. below the old workings. They ship that part of the ore which runs over 50% zinc.

TELLER COUNTY.

The leasing policy adopted by the Free Coinage Gold Mining Co. for several years past will remain in force during the present year, and few changes will be found among the lessees engaged in the development of this Bull hill estate. The leases expired by limitation on December 31, and renewals or new leases covering a 12 months period have been granted: the Pinto mine to Lowry & Rogers, last year's lessees; R. A. Young, T. L. Reid, L. A. Van Tilborg have secured a renewal of their lease on the Wilson; two sets of lessees, J. O. A. Carper and D. N. Mercer and associates, will operate different blocks on the Bison, and the Pueblo mine on Bull Cliffs. The royalties to be paid to the leasing company will be graded, ranging from 10% on low-grade milling ore to 35% on high-grade smelting ore.——At the Vindicator shaft No. 2, Whitney, McMullen, and associates are maintaining steady production, and the lease is classed as a good profit. The output from the main shaft, operated on company account, will be somewhat curtailed for the present month, due to the construction of a fire-proof steel shaft-house and head-frame. The total production from the Vindicator company's mines for January, however, will not be much less than 2000 tons.——The head-frame formerly standing at the Geneva shaft on Gold Hill has been removed to the Half Moon mine on the same hill. Harrison & Shadomey are installing an electric hoist and will shortly resume underground work.

IDAHO.

SHOSHONE COUNTY.

(Special Correspondence).—The principal feature of this week's events in the Coeur d'Alene has been the starting of a suit for the foreclosure of a mortgage for $150,000 by David M. Hyman, of New York, against the Frisco Mining Co., of which he is the president. It is alleged in the complaint that on October 1, 1907, the company, through its treasurer, J. L. Tilton, borrowed the sum of $150,000 from Mr. Hyman, at the same time giving him a promissory note for that amount. This note was secured by a mortgage covering all of the company's equipment, mill, water rights, and holdings of all sorts. Mr. Hyman claims that no part of the note has been paid and petitions that the whole of the company's holdings be sold under sheriff's sale to satisfy the debt. It is generally believed that if the control of this company passes into the hands of Mr. Hyman a large force of men will be set to work and the mine again join the list of producers.——A special meeting of stockholders of the Idaho & Montana Mining Co. has been called for February 24, to consider the advisability of increasing the company's capitalization from $100,000 to $1,000,000. The increase will be obtained by changing the par value of the stock from ten cents to $1 per share.——A report of the affairs of the company at the close of the year has been mailed to the stockholders of the Carney Copper Co. The report shows that during the year about 625 ft. of work was done on the mine, and that it is intended to offer a further block of treasury shares to the present stockholders at 7½c. per share.——A resumption of work has been made in the Hennessy-Burns mine in the Burke district and a force of men set to continue the drift. This has already been driven about 500 ft., but it is expected that 250 ft. of work will still have to be completed before the workings get under the good shipping ore reached by the upper adits.——The Surprise mine is again about to resume work. The mill at the property was completed just before the recent financial panic, and was forced to close down owing to the low prices prevailing in the metal markets.——At the annual meeting of stockholders of the Cassidy Gold Mining Co. held in Wallace, T. N. Barnard, of Wallace, was re-elected president and manager, and Miss Nellie J. Stockbridge, secretary and treasurer. During the past year about 500 ft. of work was done on a 6-ft. vein assaying from $6 to $7 per ton.——A strike of 13 in. of clean shipping galena has been made on the property of the Merrimac Mining Co. to the east of the Bunker Hill & Sullivan property. The ore was encountered about 50 ft. from the surface.——An electric plant capable of generating power for a hundred 16-cp. lamps is being installed on the property of the Hypotheek mine in the Kingston district. The plant will be run by the engine recently acquired by the company for its sawmill. A new hoist has also been installed at the mine and is giving every satisfaction.——At the annual meeting of stockholders of the Wallace Mining, Milling & Realty Co., held in Wallace, a new set of officers was elected, L. Dols retaining the office as president; Herman J. Rossi as treasurer, and Gary C. Burke as secretary. It was reported that during the year past about 250 ft. of work was done and arrangements for the resumption of development are being made.

Wallace, January 21.

Bear Top Mining Co. is considering the letting of a con-

tract for a 400-ft. raise to connect the No. 2 and No. 3 levels. There is plenty of ore in sight, and the mine will begin shipping as soon as the new road is ready. The property is equipped with a 100-ton concentrator.——Hecla mine at Burke, Idaho, produced 282,000 oz. of silver and 9,928,180 lb. of lead in 1908, as against 550,342 oz. of silver and 19,024,893 lb. of lead in 1907. The comparatively small output for the last year is due to the closing of the mine during the first five months on account of the market depression. The dividends were $190,000 last year, as against $520,000 in 1907. The total dividends to date are $1,170,000.

NEVADA.

ESMERALDA COUNTY.

Six lessees are working on the Happy Hooligan claim. There is an incline shaft down 50 ft., with a cross-cut north 60 ft., at which point was opened a body of ore over 10 ft. wide, assaying $8 per ton. The Truitt-Rawhide Mining & Leasing Co. has extended development on blocks 4 and 6. A winze is down 100 ft. from the 70-ft. level of shaft No. 3. Drifts are progressing both ways in ore which after screening over a 1-in. grizzley gives undersize assaying $25 and oversize $5 per ton. On the Miller lease is an incline shaft 65 ft. deep, in ore all the way, and a vertical shaft 130 ft. deep. The amount of milling ore on this lease, now proved, is very large.——The Rawhide Victor Mining & Leasing Co., on block 6 of the Happy Day claim, has a 12½-hp. gasoline hoist, head-frame, blacksmith shop, and a vertical shaft 200 ft. deep, with a cross-cut on the 125-ft. level, and some stoping done on the vein above this level. This vein is also cut by a cross-cut east from the 200-ft. level, with ore assaying $15.——The Grutt Hill Coalition lease on block 7 of the Wild West has been worked intermittently, driving both ways on the vein opened up on the 107-ft. level.——The Rawhide, Grutt Hill, Truitt, and the Marigold lessees are working blocks 8 and 10 through a joint shaft. The shaft is 120 ft. deep. On the 50-ft. level is a cross-cut south.——The Grutt Hill Mint adjoins the Dayton & Toledo on the south on block 10. It is equipped with a 25-hp. hoist, head-frame, and blacksmith shop. An incline shaft 300 ft. deep has been sunk. At the time of the last report this shaft was down 140 ft., with drifts both ways at the 50 and 100-ft. levels. The ore-shoot developed in this lease was about 60 ft. long, and high-grade continued to the 250-ft. level, from which the ore has been stoped and shipped.——At the Original Rawhide, known as Kearns No. 1, the vertical shaft is down 150 ft., with 200 ft. of drifts and cross-cuts. The vein averages 2½ ft., with ore assaying $22 per ton. Screenings shipped have returned $100 per ton.——The Northern Consolidated Mines Co. owns 6 claims, the Alta Fraction, and the Morrissey lease, on blocks 1 and 2 of the Last Chance claim. The vertical shaft has been sunk 300 ft.; 350 ft. of cross-cutting and driving has been done at the 130-ft. level. The vein is 3 ft. wide, showing an average value of $10 per ton.——The Consolidated Mines Co., of Rawhide, has sunk a vertical shaft 200 ft. on the Murray lease. The levels and other workings aggregate 2000 ft. The vein is nowhere less than 3 ft. wide, and in many places is 10 ft. The general average of assays gives $20 per ton. Ore ready for mill now on the dump is estimated at 3500 tons. A 10-stamp mill will start operation within a few days.——The Czar G. M. & L. Co. has an incline down 60 ft., with 100 ft. of drifts, in 8 ft. of ore. Shipments of 8 carloads of ore have been made averaging $107 per ton. There is also a vertical shaft down 90 ft., with 180 ft. of workings.——The McKinley-Hawkins lease has shipped 45 tons of ore averaging $125 per ton. The shaft on this lease is 70 ft. deep, showing 33 ft. of low-grade ore, with bunches of high-grade. There is also a vertical shaft down 100 ft. 300 ft. distant from the first, the intention being to drive for the same orebody shown in the Czar shaft.——The Royal Mines Co. has an incline shaft down 440 ft., with a 110-ft. drift on the 65-ft. level, and a 40-ft. drift at 170 ft. The vein averages 3½ ft. wide, with an average assay value of $15, while the ore in the bottom of the shaft assays $23. From the results of development work in this mine sorted ore of a total value of $13,000 has been shipped.

On his return to Goldfield from the annual meeting of the Goldfield Consolidated Mining Co., the manager, J. H. Mackenzie, made several statements as to the future policy of the company. That the Consolidated company would continue to operate the Combination mill, as there is an abundance of ore in the Combination mine to keep it going to full capacity. According to the agreement with the Combination Fraction Co. their ore would be treated at the new Consolidated mill when required, but the company has so much of its own that it cannot handle all its own product. It would therefore probably be necessary, within 8 or 10 months, to install additional stamps in the Consolidated company's new mill, as the ore reserves now blocked out in the mines are more than enough for the capacity of the plant at the present time.

HUMBOLDT COUNTY.

E. S. Chafey, of the Black Hole mine at Chafey, reports good progress at his mine. He has driven 1500 ft. of tunnels, shafts, and drifts; installed a 3000-ft. water-pipe line, made nearly a mile of wagon-road, installed a 40-hp. hoist, a boiler, and a 2-drill compressor. Then besides general improvements he has re-built the old mill and doubled its capacity.——The Cleghorn-Duke lessees of the Eureka Leasing Co. have recently purchased equipment which includes a 2¼-in. machine drill, an air-compressor, a blower, and two gasoline engines, one of 25 hp. and the other of 10 hp. It is now being hauled to the mine from Lovelock, their nearest railroad point. John Cleghorn is general manager.



Block-holing.

LYON COUNTY.

The supply of electric power has been so intermittent during the past three weeks that the crews of the Yerington mines have been able to work only about half-time, and this half-time has been at odd times. The Truckee River Power Co., has been in trouble all fall and winter over low water and frigid weather. Now it is high water and warm weather.

STOREY COUNTY.

Virginia City's output for the week ending January 16 fell almost $4000 below the last week's production, owing to lack of power and the consequent inability to hoist the ore. As usual, Ophir leads the Comstock producers, with $15,950.

WHITE PINE COUNTY.

David Simmons, an employee of the Boston Ely Mining Co., was asphyxiated by gas in the mine while working on a lower level of the property.——Two converter shells have arrived at the Nevada smelter, and it is expected that the steel for the additions to the present converter building will arrive shortly. Steel for the fourth unit of the concentrator is now all at hand, and the erection of the additions will speedily be effected.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—A concentrating mill will be built in the spring upon a lease northwest of Neck City

which has been developed by Hill, Pugh & Springs. The 40-acre tract has been tested by six drill-holes which show good ore.——The erection of a 100-ton plant will be begun at once on the Microbe lease at Spring City. The company has developed the ground at the 116-ft. level, and drifts are being run in all directions from the shaft. This mine is the farthest east in the Spring City camp, and is beyond the supposed mineralized territory.——Underground development at the Plata mine in Spring City is being pushed in preparation for the possible erection of a milling plant. The Plata shaft is situated on the top of a hill, and hence the ore is found at a greater depth than in the other properties of the camp. Three drill-holes had been put down on the lease, and it is near one of these that the shaft is being sunk.——The output for this district has been greatly curtailed during the past fortnight by the heavy snow and blizzards. The gas supply was cut off from the mines, and altogether the whole mining industry was practically paralyzed for several days. Conditions are now again normal. ——A contract has been let for a 300-ton plant on the lease operated by Barr, Gloeniger & Walsh. One feature of this plant will be the installation of a gravity tram between the second shaft and the mill. This has been tried with success at several properties in the district.——The old Bolby mine northeast of Webb City has been bought by George Ball and will be further developed by its new owner. It was formerly operated by Carterville men. The old plant will be removed and a new mill built in the near future. ——The Nortonia, west of Joplin, will be deepened to penetrate the deposit below the 170-ft. level. During the underground development considerable improvement has been made in the mill. Additional equipment has been installed, including an air-compressor and a concentrating table.

Joplin, January 23.

NEWTON COUNTY.

The Granby Mining & Smelting Co. has completed a 150-ton mill at Granby, which has been designed especially to handle silicate ore. The trial run is to be made soon. It will handle about 150 tons of silicate, although in the Joplin district it would easily handle 300 tons of galena or blende. The lower capacity for silicate is due to the necessity of close sizing. A new crusher has been installed which dispenses with the ordinary rolls. The old plant has been used for many years, and was one of the earliest mills to be put up in the district.——A 150-ton tailing mill is being erected southwest of the Homestake mine by Eastern men to re-work the Homestake tailing pile.

LAWRENCE COUNTY.

In the east end of the Missouri camp there is at present a great deal of development work. Four shafts have recently been started on the Optimo lease, and it has been demonstrated that an ore deposit continues below their present workings.——A new shaft will be begun at once on the Church ground, which lies between the Boyd shafts and the Cameron. Excellent pay dirt was found in the drill-hole. The mine will be operated by the Golconda Mining Co.——In the Lone Pilgrim shaft, which has been in process of sinking for the past six months, a rich deposit was encountered this week, and appears to be as good as any found in the Sarcoxie camp.——After long litigation the Lewellyn estate in the Belville camp is to be extensively developed, the land having been secured by Gundling & Maitland. This tract was mined more than eight years ago, and paid in royalties alone more than $80,000. This property will be developed by Gundling & Maitland, as well as by sub-lessees who are already at work. The ore is handled at a 100-ton mill.

NEW MEXICO.

SANTA FE COUNTY.

The Boston Cerrillos Co. has partly cleaned up the shaft of the Cash Entry mine, and has pumped out the water down to the 300-ft. level. The shaft is 680 ft. deep, and others are being sunk. New machinery for treating the ore has been installed and consists of a Card concentrating table, eight sets of Hartz jigs, three sets of rolls, one large crusher, and a Huntington mill. The machinery is run by a 160-hp. Corliss engine, and will have a capacity of 300 tons per 24 hours.

SOCORRO COUNTY.

The Socorro Mines Co., in the Mogollon Mtn., is erecting a 150-ton mill, a modern cyanide and concentrating plant, in connection with which they are now installing a 750-hp. hydro-electric plant at Whitewater, some three miles from the mill. The power pipe-line is 30 in. diam., while a 4-in. pipe will convey water for milling purposes. In times of scarcity of water, use will be made of two 375-hp. Babcock & Wilcox boilers and a steam engine for the generation of the power. Over a hundred men are employed on the construction of this plant, which will have a capacity of 150 tons per day.——The Enterprise Co. is re-building its cyanide mill as fast as material arrives, the former mill having been destroyed by fire a short time ago.

OKLAHOMA.

OTTAWA COUNTY.

(Special Correspondence).—A new mill has had its trial run this week in the Miami camp, and after a few days of needed adjustment the property will be ready to produce. The mill is the property of the Golden Hen, and is a first-class plant of 250 tons, every portion of the mill being new. The mill is just north of the Miami-Yankee, and is said to be operating upon the same ore deposit. There is rich ore on the dump which is ample to keep the mill running steadily.——The Swastika, a new mill in the southern end of the camp, is almost completed. It adjoins the Kenwood and King Jack, which have been producing for some time. During the building of the mill, underground work has been in progress at the 100-ft. level. It is thought that it will be sufficiently developed to supply the mill by the time it is completed.——Drilling operations are still being carried on at the John Countryman farm. The last hole encountered a steady flow of water, which with breakdowns in the machinery, have delayed the work. However, good ore has been found, showing both galena and zinc-blende. ——A rich strike of galena and zinc-blende has been made at Seneca in the old Home Run mine, operated by McClughen & Evans. The ore occurs in a vein found at a depth of 40 to 60 ft. Five shafts have been sunk, finding galena in three, and zinc ore in a fourth.

Miami, January 23.

UTAH.

BEAVER COUNTY.

Samuel Newhouse is sufficiently satisfied with the performance of the new Fink smelting process as to make plans for the installation of a 300-ton unit at the Cactus mine. He believes that silicious ores will not be so necessary as under old conditions, and that slime and concentrate will be used to great advantage. To treat the above-mentioned capacity the cost of the plant should not exceed $22,000.

JUAB COUNTY.

The Tintic Smelting company has made arrangements to secure water from the Gemini mine. The management of the smelter will use the Eureka Hill pipe-line, which extends from the Eureka Hill mine to a point a short distance from the smelter, whereby it will only be necessary to build a few hundred feet of line to connect the ends with the Gemini and with the smelter. The supply now used at the smelter comes from the Swansea mine, and while there is enough to supply the needs of the plant, the management decided that it would be best to have two independent water lines. So that with these two water lines and two separate electric lines, there is no danger of a shut-down at the Tintic smelter.

SALT LAKE COUNTY.

Samuel Treloar, manager for the Bingham-Butte Mining Co., is much gratified with the recent developments in the lower part of his mine, and intends to attempt to get the use of some of the custom mills of the Bingham camp; and failing in this, to erect a plant of his own.——The Government assay office in Salt Lake City has been thrown open for business.

Special Correspondence.

PHILIPPINE ISLANDS.

Gold Dredging on Paracale River.—New Zealand Capital in the Philippines. —San Mauricio and Tumbaga Mines.—Developments in Masbate.—Mancayan Copper.

Mining prospects in the Philippines continue to look well, but the long hoped-for mining boom which would cause a stampede of American miners and settlers into this country has not yet arrived, but it seems as if a better result may be attained by the slower influx of capital. In the last year more mining men have come to the islands, representing a greater amount of capital, than during any similar period since the American occupation. More gold bullion was produced last year than during any previous year on record, and, likely also, more than during any previous year in the history of the Philippines. More encouraging still is the increased amount of development work in progress, and the constant improvement and enlargement of the milling plants already erected.

In Ambos Camarines, at the site of the old and supposedly abandoned Spanish and English ventures of the early nineties, there is at present one gold dredge. It was brought from New Zealand and erected on the Paracale river in the early part of 1908. G. R. Fearby, a well known tin miner from Australia, who prospected the district for the New Zealand capitalists, was recently murdered by brigands in French Indo China while prospecting for tin deposits. The story is told that when Mr. Fearby reported his findings in the Camarines to Joseph Pearson, the head of the New Zealand syndicate, the latter shrewdly advised him to cut his figures in two; they seemed incredible to his associates. On the strength of Mr. Fearby's report an old dredge that had seen its best days in New Zealand, was sent out. Its capacity is only 300 yd. per day, and though it was shut down for repairs about seven weeks between May 1 and September 30, the output during this period has been about 2100 oz. gold, in addition to a large quantity of black sand containing 7 or 8 oz. per ton. Another New Zealand dredge is now being erected on the Paracale river, and a third one is being dismantled in Masbate, preparatory to being brought over to the Camarines. Systematic prospecting is being conducted on the Malaguit river about 1½ miles east of the Paracale river, and an understanding has been arrived at between the locators, which will result in new and larger dredging equipment being brought over from New Zealand.

The old San Mauricio and Tumbaga groups of quartz mines are being unwatered and re-timbered, preparatory to pushing development on these old properties. A representative of the concessionaries of the San Mauricio group is at present in the United States, trying to secure sufficient capital to renew operations. A Camarines Miners' Association has recently been organized, with A. J. MacDonald, an American, as president, and William Kane, from New Zealand, as vice-president.

Conditions in Masbate are beginning to improve once more. The Mt. Cogran and the Gold Bug mills remain shut down, but the dredge of the Lanang Mining Co., locally known as the Kimball dredge, is about to renew operations. This company, which is the successor of the old Philippine Dredging Co., was recently reorganized in Boston, and has finally cleared away all legal complications. The other Masbate dredge, locally known as the 'Gray dredge', which was brought over and erected here by the Oriental & Masbate Mining Co., at a cost of about $70,000, is now being dismantled, preparatory to shipment to the Paracale river. The Eastern Mining Co. is continuing its prospecting and development work, but is milling no ore. Added interest has been given to the recently discovered deposits of lead and copper in central and southern Masbate by the arrival of two engineers representing separate mining syndicates in the United States. Both native copper and black sulphide ore have been found, and large veins of lead ore are indicated. B. A. Green, formerly auditor of the Manila branch of J. G. White & Co., has gone to Masbate to take care of his interests in person. Edelmaier & Beasley, the two pioneers of Masbate, are reported to have struck a $90 vein of gold ore, which they are preparing to mine in a small way and ship either to Australia or to Pacific Coast smelters.

The regular shipment of gold bullion from the Benguet mines, and the constantly increasing activity in development in this and the Camarines district, has been a source of great encouragement to prospectors and promoters in the Islands. Following a succession of mining fiascos, mining capital in the Philippine Islands had become scarce. Recently, however, two new companies were successfully



Philippine Islands.

floated to prospect and open new properties on the Antamok river. Capital for these enterprises was obtained partly from English firms in Shanghai and Hongkong, and partly from business men in Manila. There are at present 18 stamps dropping in the Benguet district, with two cyanide plants of a capacity of 50 tons each. More than half of the stamps are of the quadruple-discharge type. A notable feature of the operations of the two largest producers in Benguet, the Benguet Consolidated and the Bua Mining companies, is that, in spite of the fact that mining operations have been conducted at a profit to the above corporations, no dividends have yet been paid. All profits have been turned back to improve and enlarge the treatment-plants and to extend development of the ore reserves. The managers, more particularly of the Benguet Consolidated, which is the older of the two, deserve credit for their professional efficiency and for their good business judgment.

The copper mines in Mancayán and the gold mines in Suyóc, Lepanto Province, are still waiting the advent of a purchaser. It is estimated that the severe typhoons during the last rainy season caused washouts, caves, and general

damage to the extent of over ₱30,000. The prospectors, however, are showing a splendid spirit, and do not yield to discouragement. New workings are being started and old ones are being cleaned up. It is reported that an important German smelting firm expects to have its engineers report on the Mancayán copper property within a short time.

MEXICO.

Financial Surplus. — Mineral Output. — Precious Metal Exports. — Bank Statements.—Mine Developments in Zacualpam.

To anyone interested in Mexico, its industries and progress, the recent report of Finance Minister José Y Limantour to the Mexican Congress on the Republic's financial conditions cannot fail to be attractive. Mention was previously made in these letters of the splendid reserve accumulated during the last fiscal year, notwithstanding the general depression throughout the world. Although not equal to that of the preceding year, it was far in excess of previous surpluses. The reports now at hand show in almost all lines a material increase for the fiscal year 1907-08 over that of 1906-07, and strangely this has been more marked in the production of silver than in that of any other metal. The second on the list is gold. The production of silver amounted to ₱85,446,904, or 2,153,014 kg., as against ₱77,088,837, or 1,756,704 kg., for 1906-07, an increase of ₱8,358,077, or 396,310 kg.; and the gold output for 1907-08 was ₱38,096,661, or 28,572 kg., as against ₱36,563,898, or 27,423 kg., for the preceding year, an increase of ₱1,532,763, or 1149 kg. Of other mineral substances the total production amounted to:

Copper	₱24,800,000
Lead	5,400,000
Zinc	900,000
Coal	7,000,000
Oil	2,000,000
Miscellaneous	2,500,000
Total	₱42,600,000

This, with the gold and silver, makes a grand total for the mining industry of ₱166,143,000. Of the metal exports, gold amounted to ₱32,000,000, an increase of ₱8,000,000; silver, ₱93,000,000, a decrease of ₱7,000,000, due to the lessening of the exportation of coin silver to the amount of ₱14,000,000, whereas the exportation of silver in ores and precipitates increased to the amount of ₱7,000,000. Copper exports amount to ₱18,500,000, a decrease of ₱3,000,000; lead, ₱5,500,000, an increase of ₱2,000,000; and zinc but ₱1,000,000, or less than one-half that of the preceding year. The total exports of all products, mineral and others, amounted to ₱242,740,201, and the imports to ₱221,757,464, a decrease of ₱5,277,809 and ₱10,472,144, respectively, as compared with the previous year, yet, as may be seen from the above figures, the balance of trade was in favor of Mexico to the extent of about ₱21,000,000, and in excess of the preceding year by ₱5,000,000. The railroads of the Republic show gross earnings on passenger business of ₱16,436,498, an increase of 5.89%, and on freight ₱57,933,153, an increase of 9.59%. The banks at the close of business June 30, 1908, reported:

		Increase.
Total cash on hand	₱85,570,147	₱10,322,947
Total deposits	407,139,179	7,880,832
Total capital and reserve	222,054,382	12,058,451
Total assets and liabilities	756,522,308	32,758,622

It is certainly an unlooked for showing, when all conditions are taken into consideration. Some time ago attention was called to what might be the future expected for the camp of Zacualpám, State of Mexico, by reason of the approaching introduction of cheap electric power by the Temascaltepec Light & Power Co. from its hydro-electric power-plant 16 miles distant, and the expected has now been realized in the results at present existing in the said camp. The owners of ground in Zacualpám did not await the coming of cheap power, but took time by the forelock and immediately began development of their properties, and now a number are reported in bonanza. The Seguranza (the old Coronas), controlled by George A. Waddell, of San Luis Potosí, had proved up its property, and work was started upon a 100-ton concentrating and cyanide mill, when the rainy season of last year made it advisable to suspend. Work on the mill has since been resumed, however, and it should be completed within the next four months. The Carboncillo has for some time been a producer, but developments within the last month have opened up rich ore and it is now stated to be in bonanza. The Olvidado, adjoining both the Carboncillo and the Seguranza, started operations six months ago on virgin ground, and is now in fine ore. Over 100 tons of high-grade ore has already been shipped, and the lower grade, amounting now to 10 tons per day, is being stored on the mine patio for treatment in the Seguranza mill. In the Yondese, H. L. Eisenhart has found rich ore, and in the tunnel on El Central ore was cut at 50 metres. The success of these properties, the coming of the electric power, and the approaching completion of the Seguranza mill, which will do some custom work for awhile, has given a great impetus to the district. Denouncements are being made in great numbers, and every one is sanguine of success. Even the Alacrán and the San Fernando, both of which are 'antiguas,' with many millions to their credit in the past, are said to again show ore equal to the bonanza days. Zacualpám is just now the bonanza camp. The Las Dos Estrellas at El Oro on January 1 declared a dividend of $1 per share.

BUTTE, MONTANA.

Butte Copper Output.—Mine-Fire Control.— British Butte Dredge.— Butte & New York.

Copper producers are reluctantly admitting that the metal situation is disappointing and that there is a gradual accumulation of copper. Were business conditions satisfactory the surplus copper would be considered normal, but the improvement expected to follow the defeat of Bryan has not materialized. The Butte output is gradually increasing, though a considerable falling off will be noted for January because of the complete shut-down of the Boston & Montana mines for 11 days owing to the extreme cold, which interfered with ore transportation. The Butte Coalition Co. has increased its ore production to about 1300 tons per day. The North Butte Co. continues its output at 1400 tons per day, and all the mines of the Amalgamated Co., with the exception of the Anaconda, are producing a nearly normal quantity of ore. The Anaconda mine is worked only on the lower levels because of the fire prevailing on the levels above the 1600-ft., and the ore is hoisted through the St. Lawrence and Neversweat shafts. The fire levels in the Anaconda are being sealed and everything possible is being done to keep the gases out of other workings. That method has been successfully followed in the Minnie Healey by the Butte Coalition Co. The levels have been bulkheaded and new levels opened under the fire-zone through the new Tramway shaft, and about 60 ft. of ground is left as a barrier between the old levels and the first new one. The same fire trouble has existed in the Leonard and Colusa mines of the Boston & Montana Co. and the latter is following the example of the Butte Coalition and is opening new levels under the fire-zone. The British-Butte Mining Co. will start its gold-dredge on January 30. The dredge was built by the Risdon Iron Works of San Francisco at a cost of $70,000. While the mining will for some time be confined to surface dredging, the company expects ultimately to hoist gravel from shafts. One has been sunk to a depth of 670 ft., from the bottom of which a bore-hole has been run 300 ft. more without encountering bedrock. A cross-cut has also ben driven from the bottom of the shaft eastward to the rimrock of the gulch, a distance of 1080 ft., and from the end of that 50 ft. cross-cuts have been made north and south, encountering only placer gravel, the assay values of which vary from a few cents to $3 and $4 per

cubic yard. At the first annual meeting of the stockholders of this company held in Butte last week the following directors were elected: Manuel H. DeHora, Samuel J. Barker Jr., John N. Kirk, W. E. Ward, H. A. Frank, John F. Davies, and J. W. Murphy. The Butte & New York Copper Co., which is the holding company for the Butte-Milwaukee Co., of Butte, has elected the following board of directors: James A. Talbot, of Butte, Philip Lawrence, of Huron, Leo Schlessinger, Leopold Feist, B. Binnard, G. M. Mizesheimer, L. H. Halloway, F. B. Knight, A. E. Mittenhal, L. R. Thomas, and John Allan, of New York. Five hundred thousand dollars has been spent in the purchase of property, equipment, and development. The company owns the Pollock group of claims in the North Butte portion of the district. The shaft is 700 ft. deep and the veins give good copper assays at that depth.

TORONTO, CANADA.

Templeman Remains Minister of Mines. — Suffering at Gowganda. — First Ore Shipment. — Crown Reserve. — Nipissing Mine. — Fraudulent Promoter Convicted.

It has been decided that William Templeman will retain his position as Minister of Mines, endangered by his defeat at the last general election. It was necessary to secure another constituency, and this has been effected by the resignation of William Sloan, member for Comox-Atlin. His retention in office is mainly due to the strong support he received from the mining interests, which recognize that since his appointment the department has been put upon a better basis.

The new Gowganda silver-field continues to divide interest with Cobalt, and road construction is being pushed forward as the weather permits. Owing to the steady rush of prospectors, without experience in the hardships of a new country, considerable suffering has resulted. Harrowing accounts are received as to conditions in the Gowganda district; the hotels are full to overflowing, men are glad even for a chance to sleep on bare floors; some who have pushed farther afield to do snow-shoe staking are reduced to extremity by cold and privation, and some fatalities have resulted. The Provincial Government has selected about 1000 acres at the north end of Gowganda lake as a townsite. Squatters have been warned, and the lots will be sold by tender. The Mining Recorder at Elk Lake is overwhelmed with work, and owing to a lack of clerical help prospectors have to wait for indefinite periods before their claims can be recorded. The evidence at inquests over recent fatal accidents shows that the system of mine inspection is exceedingly perfunctory. It is asserted that this is not the fault of the inspector, but is due to his having entirely too large a field for one man to cover. The Otisse-Carrie mine, Silver Lake, is the first mine of the Montreal River district to make a shipment of ore. High-grade ore is being hauled to Charlton preparatory to loading a car.

The La Rose has proved the existence of an additional body of high-grade ore. Hitherto all ore for shipment has been taken out above the 110-ft. level. A find of 4000-oz. ore increases the depth of the reserves by 90 ft. The annual meeting of the Crown Reserve was held at Montreal on January 13, about 200 shareholders being present. The statement showed a surplus of $317,117, after paying the January dividend of $283,210. John Carson, the president, estimated that the output for the current year would amount to $1,200,000, and that, allowing $200,000 for operating expenses, there would be $1,000,000 available for dividends. It is the intention of the directors to pay quarterly dividends at the rate of 24% per annum, with such bonuses as may be justified by earnings. At the Chambers-Ferland the new compressor-plant has been started for running three drills and one hoist. In the west cross-cut from the 80-ft. level of No. 2 shaft a vein 8 ft. wide consisting of calcite, cobalt, and galena was found 215 ft. from the shaft. The company has decided to use the diamond-drill extensively. During 1908 the Nipissing mine produced 7,062,527 lb. of ore, yielding 2,897,446 oz. islver, of a net value f. o. b. Cobalt of $1,384,447. The ore averaged 19c. per pound. At the Kendall shaft driving is being done both ways on the new cross-vein. The north vein has been faulted. At the south end it was split into three stringers, each averaging 1 in. wide, and assaying from 1500 to 2500 oz. The middle one is being followed. At the Meyer vein the west drift has been prepared for stoping. It is from 2 to 8 in. wide, averaging 3500 oz. silver, over a distance of 40 ft. The report of the Tretheway directors to be presented at the annual meeting January 27, covering a period of 16 months ending December 30, shows net proceeds from sales of ore of $355,680. The total revenue was $357,970, and expenditure $147,446, leaving a profit of $210,524. Dividends at the rate of 15% have been paid, amounting to $141,817, a balance being carried forward to revenue account of $68,706.

JUNEAU, ALASKA.

Rainy Hollow District.—Conrad Mine. — Alaska Mexican and Alaska United Reports.

The Alaska Iron Co. has recently paid the remaining $20,000 of the purchase price of the Montana & Arizona claim, in the Rainy Hollow district, British Columbia. The company entered into a bond in August of last year, paying down $5000 of the purchase price, which was $25,000. Since that time the property has been prospected, both by cross-cutting and by core-drills, and the results have been highly satisfactory. The richer ore carries good quantities of copper and silver.

The ice on Lake Tagish being now strong enough to sustain large teams, the Conrad mine is shipping concentrate to the White Pass railroad at Caribou for final transfer to the smelter by way of Skagway. The distance from the mine to Caribou is 16 miles, but owing to the good condition of the ice, the 4-horse teams have no difficulty in hauling from 4 to 5 tons at a trip. The concentrator is working smoothly, and is treating from 40 to 60 tons per day. The water used in concentrating is pumped from a well situated beneath the floor of the mill, so that the plant may operate, irrespective of weather conditions.

The fiscal year of the Alaska Mexican G. M. Co. and the Alaska United G. M. Co., ended December 15 last, and the available figures for the year are as follows: The main inclined shaft of the Ready Bullion mine has been carried to a point 70 ft. below the 1650-ft. level, and the station and skip-chute station have been cut. The work of opening this level will be pushed as rapidly as possible. The development work of the 1500-ft. level is completed and stoping is in progress. The mill crushed 231,570 tons of ore, having an average assay value of $2.70. An average of 10.37 machines was at work during the year, drilling 37.50 ft. and breaking 34.4 tons of ore per shift of 10 hours. A saving of 4512 tons of concentrate was made, or 1.95% of the ore milled. The average duty per stamp was 5.37 tons per 24 hr., and during the year 505 chrome shoes and 295 dies were used. The total amount of mercury fed was 46,175 oz., of which by far the larger amount was used inside the batteries. Of the total fed, 15,378 oz., or 33.30%, was lost.

The main shaft of the Mexican mine has been sunk to a point 1470 ft. below the surface. Stations and skip-chute stations have been cut at the 1210, 1320, and 1400-ft. levels. The 1400-ft. level is at the same depth as the 1450-ft. level of the Treadwell mine, and the two will be connected. From this mine 245,955 tons of ore was sent to the mills, 147,474 tons going to the Mexican mill of 120 stamps and 98,481 tons to the Seven Hundred mill of 100 stamps. The average assay value of the ore milled was $3.02. The average number of machines at work in the mine during the year was 10.12. The average amount drilled per machine in a shift was 28.96 ft., and the average amount of ore broken per drill per shift was 29.30 tons. In the Mexican mill 3723 tons of concentrate was saved, or 1.54% of the total ore milled. The average duty per stamp per 24 hr. was 5.59 tons; and during the year 529 chrome-steel shoes and 270 cast-iron dies were used. The mercury fed was 61,008 oz; of this amount 20,260, or 33.21%, was lost.

On the 1450-ft. level of the Treadwell mine the main cross-cut has reached the slate 'horse' dividing the north from the south orebodies. The ore exposed in the south orebody is 160 ft. wide, and up to the present time the length shown by the drifts is 300 ft., all in good ore. Sinking will be resumed shortly in this mine, either continuing the No. 2 shaft or starting a winze from the 1450-ft. level.

JOHANNESBURG, TRANSVAAL.

Status of Diamond Mining. — De Beers Consolidated, and Premier Diamond Mining Company.—Policies Compared.

So regular and detailed are the reports of Rand gold-mining companies, and with such thoroughness are their monthly yields and profits analyzed by the Chamber of Mines, that it is common in South Africa to regard the diamond mining companies as immoderately reticent. It is apparently hard for people, accustomed to the gold mining industry, which gives rise to no commercial competition, to realize the necessity for De Beers, the Premier, and other diamond producers, to closely preserve the secrets of administrative policy, and to ignore the demands of shareholders for information. The events of the past week, however, have thrown light upon the diamond mining situation, which, though not altogether cheerful, is welcome after the long period of doubt. The meeting of the De Beers Consolidated has been held in Kimberley, and its annual report issued, the premier company has also issued a yearly statement, and, in addition, invited the members of the Chemical, Metallurgical & Mining Society to visit the mine and observe the vigorous work of construction proceeding to provide the means for increasing the output.

The reports and programs of these giants of the diamond world present a striking contrast. The Kimberley corporation reviews the position with a caution expressive of mature experience; the tone of discretion and the greater forethought are suggestive of the mental attitude of middle age, while the Premier company takes up the bold devil-may-care position of the self-sufficient young man, confident of his strength and infallibility, who will not stoop to co-operation—who will fight his rivals and lose rather than resort to compromise.

The records of production for the year ended October 31 were published by the Premier D. M. Co. a short while ago, but financial details were only made available on December 19. Upon combining these two statements the following summary of the year's operations may be compiled: ground treated, 8,145,794 loads; diamonds won, 2,078,825 carats; yield per load, 0.25 carat; working costs, 1s. 10d. per load. (Load equals 16 cu. ft.) Comparing these figures with the returns for the previous year, it is to be noted that the increase is 1,607,000 loads, a fact forcibly expressive of the company's decision to entertain no proposals from Kimberley for a curtailment of operations during the period of depression. The value of the diamonds produced during the year is given as £1,536,000, equivalent to less than 15s. per carat, while the stock on hand in 1907 was worth £164,000. Actual sales, however, aggregate £1,104,000, leaving stones valued at £596,000 on hand. Of the realized profit (£358,000), £256,000 has been applied to capital expenditure, another indication of the company's headstrong policy. The reduction of working costs to 1s. 10d. per load is highly creditable to the technical administration. The decrease in yield per load is entirely due to natural considerations and cannot be criticized. The gradual fall in grade appears in the following table:

Year.	Loads Washed.	Carats Produced.	Yield Per Load Carats.
1903	76,931	99,208	1.290
1904	939,265	749,643	0.798
1905	1,388,671	845,652	0.609
1906	2,988,471	899,746	0.301
1907	6,538,669	1,889,937	0.289
1908	8,145,794	2,078,825	0.250

In addition, the decrease in value of the product from between 22s. and 29s. per carat to 15s. per carat makes manifest the conditions prompting the directorate to rely upon quantity rather than quality for realizing aggregate profits in accordance with their ideas of the capabilities of the mine. It is clear that the producing capacity of the 'pipe' is enormous, but the absorbing capacity of the market is unhappily restricted. Whereas the Premier company has been dazzled by the former circumstance, the De Beers has been influenced to pursue a policy of prudence by consideration of the latter.

An examination of the report of the Kimberley corporation reveals a maintenance of value per load that is remarkable, and the apparent decrease is largely attributable to the fact that no diamonds were sold between February and June, the most critical period of depression, and that the stones won were taken into stock at the actual producing cost. On this basis of valuation, the diamonds won during the year are assessed at £3,354,000, with an expenditure of £2,630,000. This shows a decrease, as compared with the preceding year of unsurpassed prosperity, of £3,098,000 in revenue and £1,215,000 in expenditure. To achieve this reduction, it was necessary to close down the Dutoitspan and De Beers mines, while the Premier was forging ahead with its scheme of expansion in the northern colony. It has been pointed out again by the chairman of De Beers that such competition could not be withstood but for the difference in quality of the stones produced. Had the class of product been closely similar in the two centres, and had the Premier company, notwithstanding, pursued its own course regardless of De Beers, there would have been warfare with disastrous results. The De Beers Consolidated, however, has striven consistently to prevent a glut of diamonds. Hence the statement of diamond sales, accredited to each mine of the group, compares quite favorably with previous returns, as follows:

	1907. Carats per Load.	1907. Value per Carat.	1908. Carats per Load.	1908. Value per Carat.
		s. d.		s. d.
De Beers and Kimberley	0.37	64 9.7	0.37	58 0.8
Wesselton	0.32	41 1.3	0.27	38 11.4
Bultfontein	0.32	43 6.3	0.32	41 4.8
Dutoitspan	0.24	79 6.8	0.23	74 5.1

These figures are for the year ended June 30, and prove conclusively that there has been no selling at 'bargain' prices, and the news now to hand that a powerful diamond syndicate is being formed, with Sir Julius Wernher and Solly Joel in control, gives assurance that no suicidal market developments will take place. So far as the fine-quality stones of De Beers are concerned (and the new Jagersfontein mine falls under the same influences), the supply will only meet the demand at prices roughly on a par with former standards. There are now other diamond mines in South Africa, notably the Voorspoed, which stand outside the two great groups, and which may eventually constitute a factor of importance in the trade, but during the present year at least, the situation will be completely dominated by the policies of the older producers. The reports of rich finds in Damaraland, southwest Africa, have lately been interpreted by sanguine supporters to herald the development of a new producing region of 'vast potentialities', but so far as reliable information in Johannesburg goes, the stones have been found only in shallow drifts, and have been almost exclusively of small size.

The extracts from the published reports discussed above indicate the policy recently adopted by the De Beers Consolidated, and also disclose the results obtained by the Premier during the year. At the Premier mines, the first two plants erected were for direct treatment, without weathering or crushing. Only the very friable surface material was amenable to direct washing. A new crushing and washing plant was put up. This commenced work in 1905. Its capacity is 20,000 loads per 24 hr. By the middle of 1909 an additional plant will be ready.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

The Alaska-Treadwell mine consumes 21,600 cases of No. 1 and 21,204 cases of No. 2 dynamite each year. A case holds 50 pounds.

Mines are often spoiled by the attempt to get low costs, a big tonnage being obtained by free admixture of waste. Others suffer by the effort to lower the tailing to a degree more academic than commercial.

Location of quartz or lode claims may be made without restriction as to number by one individual. Such claims may be contiguous or non-contiguous; on the same lode or not; located on the same day or at any time; unless local district regulations or State statutes have otherwise provided.

Protective coating for cyanide vats should contain an asphalt base. Ordinary asphalt and coal tar, half and half, applied hot, is as good a coating as can be used. Two applications are necessary. The outside of the vat may be painted with the same mixture, or with ordinary paint containing a white lead 'body'.

Rectification of the boundary of a mining claim by an amended location, throwing open a strip of ground which had been comprised within the limits of the original location, leaves such strip available for location by any person, including the original locator. The new location covering such strip may be made immediately.

More men are killed in timbered than in un-timbered mines, for timbering indicates heavy ground, and the best of timbers may hold the ground without protecting the miner. In bad ground, timbers are apt to be a snare, for in most cases the machine-drill is set up beyond protection, and in hand-drilling the miner must work under overhanging rock.

Platinum at present is selling at $24 per ounce for refined metal and $20 for crude. Although the prices soared close to $40 during the boom, it would be unsafe to estimate higher than $18 or $20. The great market for platinum is Paris, but buyers in New York will pay as good prices as the Parisian brokers.

Cyanide vats should not be constructed of green lumber. Unless it were all uniformly saturated, unequal shrinkage would result, and furthermore, the gradual shrinkage as the lumber seasons would cause trouble unless the work were done with even greater care than is necessary with dry stock. It would pay to make a kiln and dry the lumber locally, rather than employ it in a green state.

In re-tracing the lines of a mining claim recently it became necessary to determine which of a number of blazed trees was the original line-tree marked in 1882; the blazes having been partly covered by new wood in every case. Sections about two inches cube were cut from a number of trees through the blazes and the new annual growth rings counted. When the tree thought to be on line was thus treated 24 rings were found above the blaze, which was taken as conclusive evidence that that was the right tree, since none of the others showed over 10 or 12 rings.

Trap is one of those general geological names used to signify an igneous rock of a basic, dark-colored, fine-grained character, such as diabase, dolerite, and well-crystallized basalt. Some mica rocks, occurring in dikes, are known as mica-traps. The use of the word is popular rather than strictly scientific. It is derived from the Swedish word *trappe*, meaning a step, relating to the peculiar step-like forms of certain volcanic flows.

Tungsten ore is mined extensively in the Nederland region, Boulder county, Colorado. The mineral is chiefly ferberite, which is essentially a tungstate of iron, containing about 61% tungstic oxide (WO_3), 20 of ferrous oxide (FeO), and from 6 to 16% silica, and a few per cent of alumina. Wolframite is a tungstate of iron and manganese, containing about 76% tungstic oxide. The tungsten ores rarely exist in a high state of purity, and silica is generally present in large amounts.

A mining claim, No. 1, is owned jointly by A and B. No. 2 and 3, adjoining No. 1, are under the exclusive ownership of B. Can B perform his yearly assessment work for claims No. 2 and 3 upon claim No. 1? The actual case is that a lease was given on claim No. 1, and $300 worth of work done within the year. Can this apply to the other claims as well? In reply it may be said that the solution of the question is involved in considerable doubt. The Land Department would not accept such work for patent purposes. The Land Decisions have held that claims upon which 'group work' is performed must be contiguous, and that there must be unity of title in each claim included in the group. While the courts have shown greater liberality in ruling on the question of annual labor, there ought not to be any distinction in principle between the character of the work required for both purposes. It is true that one of the California State courts has recently intimated that, providing there is an understanding between owners of adjoining claims, work done entirely outside of such claims may be held to benefit them all, in spite of the absence of community of ownership. However, until this question has been passed on by the United States Supreme Court, it cannot be said to be placed beyond the realm of doubt. In the absence of a mutual understanding, a co-owner clearly cannot perform work on a claim held in common with another and credit it as assessment work on adjoining claims held in sole ownership. Business prudence would ordinarily dictate the policy of performing annual labor on each claim, where there is any question as to its applicability and sufficiency, rather than to be compelled later on to litigate an adverse title initiated upon the ground that the work had not been properly performed.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Cushioning Vibrations of Cam-Shafts.

The Editor:

Sir—I have read with interest Mr. Algernon Del Mar's article on this subject in your issue of even date. There is room for great improvement in this part of the mill, and Mr. Del Mar's article is helpful to the mill-man. The article states, however, that by this device the drop of the stamps can be changed by "taking out and replacing at will" pieces of belting. It is my opinion that this would occasion more loss of time than the old method of setting the tappets. To remove the cushion the cam-shaft would have to be shut down, whereas a first-class mill-man will set a tappet on one stem while the remaining four are running, thus continuing the crushing without loss of time.

THOS. N. MILLER.

San Francisco, December 26.

Forest Reserve and Mining.

The Editor:

Sir—I have been reading with pleasure and interest the letters published in your journal, concerning Forest Reserve matters.

Below are a few things observed by one that has been engaged in prospecting and mining for 18 years, during which time I have located, bought, patented, worked, and sold mining claims, and still have considerable mining interest in a National Forest. For the past two years I have been connected with the Forst Service.

The Forest Service can, and, I believe, will be made a benefit to the mining interests, but at present, in some cases, it is annoying to mining companies and prospectors. The privilege given, by the act of June 11, 1906, in regard to homesteads in Forest Reserves, may be used to blackmail honest mining enterprises. Any citizen may make application for examination and listing any possessory mining claim; the Forest Service is very slow to make these examinations, and then they are sometimes made by parties that are incompetent, through lack of experience in mining; pending these examinations, the miner cannot sell his claims, because of clouded title. The lode claims are also subject to examination before title can be perfected; these examinations are also sometimes made by parties that lack experience in mining. Still, if these examinations were made expeditiously by competent parties, it would be a benefit to mining companies and prospectors, as it would do away with an element of uncertainty that existed, even before the creation of the Forest Reserves.

There is no question in my mind but that the Forest Service is doing the public a great benefit in preventing the passing of title to land that should remain with the Government. The Forest Service is helping mining companies and prospectors greatly by building trails, roads, and telephones, and last but not least, by preventing forest fires.

I am living in what is strictly a mining district, and the public sentiment is not strongly adverse to the Forest Service, in fact, many are outspoken in favor of it. There has been some friction caused by the arrogance of some Forest officers, together with the unreasonableness of some mine-operators. These things will be remedied in the future, but not without the help of criticism. The critics of the Forest Service are better friends of the Service than those that try to uphold some of the present methods.

A FOREST OFFICER.

Salt Lake, January 10.

Simplified Spelling.

The Editor:

Sir—I have noticed in your columns several sneering references to the simplified spelling movement; I think you are wrong, and I wish to protest against your attitude. I should like to know just what your attitude is. You evidently think that the English language needs improvement, for you are trying to force a new use of the word 'tailing' upon mining engineers. I, for one, have never heard it used in speech as you use it in your newspaper.

I hope further reflection will induce you to use your influence in favor of a more important linguistic reform, and that, as a first step, you will allow me to give your readers some account of the need of simplifying our spelling; because some of them, at least, have probably been misled by your jocose remarks.

Every student of English admits that our spelling is chaotic. There is not now, and there never has been, any standard spelling of English. Some of our erratic spelling, tho not 'made in Germany', is of German origin, and is due to German printers, who were brought to England to print our earliest books. Partly as a result of their ignorance of English "the spelling in the masterpieces of Elizabethan literature is a marvel of incompetency and orthographic recklessness."

That there is a vast waste of energy over disputed spellings can be seen by examining any recent dictionary. The Standard, for example, has a list of nearly 3000 words whose spelling is disputed. All the important dictionaries, and 57 philologists, have been consulted as to the spelling of these words. A rough estimate made by counting the references under several words, shows that about 200,000 opinions are recorded in this one list. But the great labor in making this list has settled nothing; it is merely a list of disputed spellings. It is certainly time that the English-speaking people should take up this question in earnest and establish some standard of spelling that the ordinary man can trust to when his spelling is questioned.

But much worse than the burdens cast upon the dictionary-makers are the weary hours spent by our children in trying to learn to spell—I say *trying* advisedly, for no one ever does learn to spell English

perfectly. So much of our children's time is taken up by spelling that they are said to be fully a year behind German children in their general knowledge. But even worse than the loss of time in trying to learn to spell is the demoralizing effect of the child's discovering that so important a subject as spelling is governed by no fixt laws. By the time he has learned the vagaries in the spelling of such words as *bough, plough, rough, tough, slough,* and *through,* his regard for law has received a severe twist, and he has acquired a "disbelief in learning and a total lack of confidence in inference."

It is to call attention to this stupid state of affairs, and to help remedy it, that the Simplified Spelling Board has been formed. This Board is a voluntary association of men who are specially interested in the question of spelling reform. It consisted when first formed (early in 1906) of 12 professors, 11 editors—including the editors of the Century, the New English, the Standard, Webster's, the English Dialect, and Skeat's Etymological dictionaries (practically all the important dictionaries of the language), and in addition to these editors and professors some 16 other prominent men, including Theodore Roosevelt, Mark Twain, and David Brewer. Among the professors I will only mention James W. Bright, Professor of English Literature in Johns Hopkins University; Richard Watson Gilder, editor of the Century magazine; Francis A. March, Professor of English in Lafayette College, and author of the Thesaurus Dictionary of English; Andrew D. White, formerly President of Cornell University; and last the benefactor who is furnishing $15,000 annually for the expenses of the Board—Andrew Carnegie. It is self-evident that the opinion of such men as these, especially when they speak of their specialty, should be listened to with respect.

From the rabid attacks made on this Board one would think that they were doing something very revolutionary. As a matter of fact, all they have done is to call public attention to the need for a reform in our spelling, and to issue a list of 300 words, already spelt in several ways, and to advise that the simplest spelling of these words be followed. The Board has not suggested a single new spelling; the only word that could be called new in their list, is *thru* (for through), and this is the spelling adopted by the Philological Societies (American and British) in 1886, and by the National Educational Association in 1898, long before the Board was organized.

The Simplified Spelling Board has invited all interested persons to sign a card agreeing to use "some or all of the three hundred simplified spellings in their letters." Twenty thousand people had signed this agreement up to June 1908.

The Leag of Editors and Publishers now uses simplified spelling in more than three hundred newspapers and magazines, perhaps the most important of these being the Literary Digest. And, as is well-known, the spelling is used by some departments of the United States Government, and is considered important enough to have a special Government publication to itself. (This can be had from the Superintendent of Documents, Washington, for 25 cents.)

This movement to simplify English spelling finds supporters wherever the language is spoken or studied. In England, which is popularly supposed to be the home of conservatism, the campaign has been started by the formation of a society whose president, Walter W. Skeat, Professor of Anglo-Saxon in Cambridge, and author of 'An Etymological Dictionary,' says, "is to consider carefully the whole subject of the history of our modern English spelling, with a view to the initiation of such a moderate system of small reforms as may seem to be generally advisable."

Among the vice-presidents of the English society are F. J. Furnivall, the former editor, and Sir J. A. H. Murray, the present editor of the New English dictionary. Both of these scholars are also members of the Simplified Spelling Board. The New English dictionary, now nearly completed, will be the largest and most scholarly dictionary ever published. It is based on 3,000,000 quotations, collected by 1300 readers, and studied by the greatest English scholars. The fact that these profound philologists support simplified spelling will greatly hasten its adoption. Because of the renown of the founders of this English society the English press has, for the most part, treated the question of simplified spelling with respect. The following remarks of Dr. Skeat seem to have been taken to heart by the journalists:

"We must enable the present race of newspaper contributors to become ashamed of discussing so confidently and so scornfully a subject which they only contemn because they do not understand it; and regarding which they employ unfair illustrations because they do not know that they are unintentionally becoming dishonest. Any man can make cheap fun of reasonable proposals, and can obviously do so the more easily if he unconsciously misunderstands and misinterprets the facts. The extent to which he is ignorant of the history of the discussion is daily being illustrated by the readiness with which he adduces, as if they were quite unanswerable, the stale objections that have been refuted many times and oft. A critic would do well, in conformity with common decency and fairness, to ask himself the question whether he knows enough of the matter to entitle him to an opinion. Let him first of all learn the right answers to a few elementary questions. Why, for example, do we spell *oak* with *oa*, but *spoke* with an *o* and a final *e*? How came *ou* to denote the dipthongal sound which is heard in the word *house*, while the same sound is exprest by *au* in German? How came the same symbol *ou* to denote the *ou* of *soup*? How is it that the sound of *a* in *cake* can be represented in at least twenty-one different ways, and the sound *ee* in *feet* in twenty-four different ways?"

It is of interest to note that this simplifying of our spelling is but part of a world-wide and inevitable reform. Great changes have already been made in German spelling; French spelling is being reformed by the French government, acting thru the Academy; Holland is changing her spelling; Russia is discussing the dropping of useless letters that will save a twelfth of her printing-bill.

Objectors to reformed spelling say that we ought to preserve inviolate the spelling of our ancestors. Here is an extract from Rider Haggard's 'King Solomon's Mines,' which some one has put into "Elizabethan orthography":

"We got up and drest ourselues for the fray, eache putting on oure chayne-armour shirte, for whiche at the present juncture we felt exceedinglie thankfull. Syr Henrie went the whole hogge about the matter, and drest himselfe like a natiue warriour. 'When you are in Kukuanaland, doe as the Kukuanas doe,' he remarked, as he drewe the shininge steele ouer his brode showlders, whiche it fitted like a gloue. Nor dide he stop there. At his request, Infadoos had prouided him with a compleate sette of warre uniform. Round his throte he fastened the libbard-skynne cloke of a commanding officere, worn onlie by generalls of hie ranke, and round his center a magnificent moocha of white oxetayles. A paire of sandals, a leglett of gotes hayr, a heuie battleaxe, with a rhinoceros-horne handle, a round iron sheelde, couered with white oxe-hyde, and the regulation number of tollas, or throwinge kniues, made up his equipmente, to which, howeuer, he added his reuoluer. The dresse was, no dout, a sauage one, but I am bounde to saye I neuer saw a finer sight than Syr Henrie Curtis presented in this guyse. . . ."

We have certainly simplified the spelling since those days, and the end is not yet.

Other objectors say that simplified spelling will so alter our words that their etymology cannot be traced. The ordinary user of language cares as little for the origin of the words he uses as does the user of a fountain-pen care for the name of the forest where the rubber trees grew that supplied the rubber of which it is made. One who wishes to study etymology can find plenty of material in the works already published, and works published after today are of no use to the searcher for the etymology of a word which already exists.

English is now the most widely used, and most important commercial language. A simplification of its spelling will make it easier for foreigners to learn, and thus aid it in its struggle for supremacy as a world-language. As pointed out by the veteran publisher, Henry Holt, a simplified spelling will save millions of dollars annually by lessening the work of authors, compositors, proof-readers, and printers. A greater boon than any mere money-saving will be in the lessening of the task of our school-children, and the showing them that law and order rule English spelling.

While I personally think that the adoption of a scientific alfabet is needed to finally settle this question, I feel that the reforming of our spelling can safely be left in the hands of our great scholars. But, surely, the duty of every man is to help this work to the extent of his powers and neither should he sit in Budda-like immobility with folded hands, nor should he follow the advice of another Oriental religious leader, the Chinese sage, Lao Tzu, and "do nothing and all things will be done." But either of these two attitudes is better than sitting on the fence and throwing stones at the procession as it moves on its way toward the goal of a scientific spelling of English.

WILLIAM H. SHOCKLEY.

San Francisco, January 15.

Note. Most of the information in this letter has come from the publications of the Simplified Spelling Board, No. 1 Madison avenue, New York. These are sent to anyone who asks for them. The remarks on the English movement are taken from the Literary Digest, of December 5, 1908.

[In courtesy to Mr. Shockley we have not edited the 'reformed' spelling used by him in a few cases; in courtesy to the reader we shall not follow this lengthy communication with another, for we discussed the subject thoughtfully and carefully in our issue of September 29, 1906, to which Mr. Shockley makes no reference. He was probably examining a mine in the wilderness and happened not to see that number. We are glad to give space to views so opposite to our own.—EDITOR.]

Progress in Cyanidation.

The Editor:

Sir—I had the pleasure of reading in your issue of January 2 the article by Alfred James upon the 'Progress of Cyanidation' during the last year, and I find myself obliged to make a correction. It is true that until the month of June last we had a ball-mill at work with its grinding pan for dry-grinding, but the class of ore which this mill ground was precisely like that ground in the Chilean mills. It is an ordinary quartz ore, the only notable difference in the two cases being in the size of the feed; for while we fed ore from 3 to 4 in. diam. into the ball-mill, the size going to the Chileans was 1½ in. as a maximum, that being most appropriate for mills of that type. Neither did we feed soft ore to the Chilean mills.

FRANCISCO NARVAEZ.

Pachuca, Mexico, January 11.

Protection of Investors.

The Editor:

Sir—In your issue of January 9, on page 83, an error of one word in the first sentence of my communication to the San Francisco section of the Mining & Metallurgical Society completely changes the meaning. It is there stated that "Itemizing is a ready means of observing results." As originally written, the word 'obscuring' was used in place of 'observing'.

I regret to have to add that the blunder occurred in my office, as I discover that the carbon copy of the typewritten article shows that you have followed copy correctly.

THEO. B. COMSTOCK.

Los Angeles, January 11.

A tax of one cent per ton on bituminous coal, to create a fund for the relief of sufferers from coal-mine accidents, was proposed by the American Mining Congress at its meeting at Pittsburg in December last. As the output of bituminous coal in America is about 380 million tons, such a tax would produce $3,800,000 per annum.

EARTHQUAKE FORECASTS.

By G. K. Gilbert.

*There was a time when the weather belonged to the gods. Storms and drought were inflicted on man in punishment or for vengeance, man strove to avert them by sacrifice or prayer, and the priest was his intercessor. Now the weather belongs to nature, and the priestly robe has fallen on the Weather Bureau. Man's new agent, however, is not an intercessor; he does nothing to placate; he makes no attempt to control the course of nature; but inspired by science he foretells the coming changes so that his lay client may take warning and be prepared. The crops are harvested before the rain, the herds escape from the lowlands before the flood, the ships reach harbor before the gale; and man chants a hymn of praise to science.

There was a time when the earthquake was equally enveloped in mystery, and was forecast in the enigmatic phrases of the astrologer and oracle; and now that it too has passed from the shadow of the occult to the light of knowledge, the people of the civilized earth would be glad to know whether the time has yet come for a scientific forecast of the impending tremor.

Next to verity, the factors which give value to an earthquake prediction are definiteness as to time and place. If the geologist Whitney, in warning San Franciscans forty years ago that their city would suffer by earthquake, had been able to specify the year 1906, and to convince them that he had warrant for his prophecy, the shock, when it came, would have been a phenomenon only and not a catastrophe. If any of those mysterious oracles who were said to have predicted earth convulsions in 1906 had named San Francisco, and told their reasons, the course of history might have been different.

Let us consider first the possibility of scientific forecast as to place, and in so doing let us assume the point of view of the resident. The factor in which he is personally interested is the factor of danger—danger to life, danger to property, danger to the present generation. Except as a matter of curiosity, he is not concerned with faint tremors and minor shocks, nor with violent shocks likely to come after centuries of immunity. It will be convenient to embody our point of view in a concise term, and the adjective 'malloseismic' will be used to designate localities likely to be visited several times in a century by earthquakes of destructive violence.

Experience.—The most important of all bases for the indication of earthquake localities is experience. Where tremors have been frequent in the past, there they are to be expected in the future. This premise is founded on our confidence in the continuity of the great processes concerned in the evolution of the earth.

Other bases for forecast are connected with our conceptions as to the origin of earthquakes. The theory of earthquakes now generally accepted ascribes them to the sudden breaking or slipping of rocks previously in a condition of shearing strain. Exception should probably be made of some of the shocks accompanying volcanic eruptions, but volcanic shocks constitute a class by themselves, to which it is not important to extend the present discussion. In non-volcanic, or ordinary, examples it is believed that strains arise in connection with changes exhibited superficially in the deformation of the surface. Fracture occurs when and where the internal stress exceeds the strength of the rock, and a fault results. Slipping takes place when the stress along the plane of a pre-existent fault exceeds the force of adhesion. In either case it is the instantaneous character of the separation which occasions the jar.

Bold and High Ranges.—It was pointed out by Powell that, because erosion is greatly stimulated by altitude and high declevity, lofty mountains must be regarded as young; and under the principle of continuity young mountains created by uplift are presumably still growing. They are, therefore, phenomena of diastrophic activity and presumably belong to malloseismic districts. The conspicuous example is Mt. St. Elias, which rises boldly 20,000 feet from its base, which was shown by Russell to have continued its growth during the life of the existing marine fauna, and which recently has been signalized by earthquakes of the first class.

Fault Scarps.—Along the bases of block mountains the lines of their limiting faults are sometimes marked by fresh scarps demonstrating recent increase of uplift. In the Great Basin these scarps traverse the alluvium of the piedmont slopes, a surface of such simple type that their presence or absence can be observed with confidence. Their presence suggests diastrophic activity, and the suggestion is strengthened when their relation to phenomena of weathering and erosion is such as to show that they were produced by a series of recent uplifts instead of one only.

Rifts.—A third physiographic criterion is illustrated in California, and was brought to general attention by the San Francisco earthquake. The slip causing that shock occurred on the plane of a fault which outcrops at the surface and has been traced for hundreds of miles. The attitude of the plane is vertical, but the displacement along it was horizontal; and there is reason to think that earlier movements on the same plane were horizontal also, for the fault does not separate a ridge of uplift from a valley of depression but traverses both valleys and mountains. At all points it is included within a belt of peculiar topographic habit, which the investigating geologists have designated as 'the rift'. Within this belt, which ranges in width from a fraction of a mile to several miles, are numerous ridges and troughs, long or short, level or inclined, and approximately parallel to the trend of the belt. Each of these represents a dislocated tectonic block, and the dislocation is of so recent date that the disturbed drainage has made little progress toward the restoration of normal conditions. Lakelets are numerous, and streams wander irregularly. Other belts of the same

*Abstracted from advance proofs of a presidential address to the American Association of Geographers, read at Baltimore, January 1, 1909. By courtesy of the author.

character have already been found in California,* and their discovery elsewhere may confidently be expected.

Rift topography appears to be the surface expression of a species of repetitive horizontal faulting, just as the fault-scarp is the surface expression of vertical faulting. The features of the San Andreas rift—the one associated with the San Francisco earthquake—were neither created nor greatly modified at the time of that shock, but such modifications as were made were of such character as to accentuate and perpetuate the peculiarities of the belt. The belt itself would be the natural result of a long series of such events, succeeding one another with such rapidity as to dominate minor aqueous agencies in the modeling of the surface.

Geologic Formation.—Fault-scarps and rift-belts serve to indicate some of the foci of past and future earthquakes. Other foci lie wholly within the earth's crust. Whether the rupture occurs above or below, its jar is propagated through the crust in all directions and affects a large area of the surface. Within this area the intensity of the shock varies primarily with distance from the origin, but it varies also with the character of the geologic formation at the point of emergence. The variation with formation has less range than the variation with distance, but is not less important to the resident and the sojourner, the architect and the engineer—that is to say, it is equally important in forecasting areas of dangerous energy. The portion of San Francisco most intensely racked by the shock of 1906 stood farther from the fault line than the portion least affected, but it stood on less coherent soil.

Turning now to the time factor in forecasting, and retaining the point of view which emphasizes the element of danger, let us inquire what methods are available for the prediction of the time of occurrence of a destructive earthquake at a given locality or in a given district.

Rhythm.—Because we are surrounded by and immersed in the rhythms of art and nature, and because the earthquake is a recurrent phenomenon, it is easy to infer that the interval between the last shock and the next will be similar to that between the last and its predecessor. Reasoning of this general tenor probably underlies the greater number of lay forecasts, and is in particular responsible for the widespread popular belief that a place recently devastated is *ipso facto* immune for several decades, or at least for several years. A similar belief prevalent among men of science has a slightly different origin, but is even more strongly held; and there is little exaggeration in saying that our guild recognize it as a duty, when the terror-stricken inhabitants of a racked and ruined city seek safety in the open spaces, to assure them that the danger is past and urge them to return to their homes. Now, it is not at all true that either the great shocks or the small shocks are separated one from another by regular or approximately regular intervals; and it is not at all true that immediate danger is past when a great shock has wrought its havoc; and yet I am prone to believe that the rhythmic principle does hold place in the mechanics of earthquakes.

The United States has one well known malloseismic district, a district including central and southern California, with areas in Mexico and the Pacific Ocean, and possibly extending northward. Alaska also contains a district, and there may be a third in Utah. Since the beginning of the last century Alaska has experienced at least nine shocks of destructive rank; but the record is fragmentary. For the California district eleven are listed, within the same period. To these we may tentatively add the Oregon or Klamath earthquake of 1867 and the Sonora and Arizona earthquake of 1887, raising the number to thirteen. In other parts of the United States were the New Madrid (1811-12), the Charleston (1886), and a relatively weak but probably destructive shock in the New Madrid region in 1865.

The average interval between the individuals of the California series was nine years, and the separate intervals, in order, were: 12, 24, 3, 18, 8, 2, 1, 4, 15, 5, 6, and 8 years. As the centres of disturbance were scattered through the whole district and the areas of dangerous violence were of moderate dimensions, the danger record for any single locality was smaller, and the intervals correspondingly larger. In San Francisco, for instance, the last five destructive shocks have been separated by intervals of 26, 3, 30, and 8 years.

The single element of order which unquestionably belongs to the sequence of quakings is implied by the term 'after-shock'. Every great shock is followed by a train of minor shocks, the length of the train being roughly proportional to the magnitude of the initial shock, and the average strength and frequency of the shocks diminishing with the lapse of time. Usually also the great shock is preceded by faint tremors, or by a few small shocks. The prelude, the great shock, and the train of after-shocks, together constitute a typical seismic event, and if their sequence could be absolutely depended on, the terror of the great shock might rationally be palliated by the thought that the worst is over. But unfortunately there are exceptions, and the character of the exceptions is not reassuring. Occasionally the prelude includes a shock of great power, and occasionally the train of after-shocks, instead of being wholly subordinate in intensity, includes one or more major shocks, rivaling the initial shock in violence. Of the 25 American examples, 14 were normal and 2 abnormal, the others remaining unclassified because

*The only rift-belt besides the Andreas which has yet been traced for any distance is one which follows in a general way the western base of the Berkeley hills. In the vicinity of Oakland its position is indicated by a trough among the lower hills two or three miles back from the piedmont plain. At Haywards it coincides with the western base of the hills, and at Irvington, with the western base of a projecting spur. In Berkeley also its line follows the base of the hills, but a little northward it climbs to the summit of the first ridge. The principal fault occasioning the earthquake of 1868 was in this rift-belt, running from Haywards southward, and it is probable that some of the earlier recorded earthquakes were associated with the same belt. The fault of 1868 is described, and the rift belt is mentioned, in the 'Report of the California Earthquake Commission,' Vol. I, Part II, pp. 434-5 and 447.

too little is known of them. It is possibly significant that the two abnormal earthquakes were of exceptional power, the New Madrid heading the list for the United States, and the Yakutat, of Alaska, being of the same order of magnitude.

Alternation.—The principle of alternation in the occurrence of earthquakes has already been touched. When a large amount of stored energy has been discharged in the production of a great earthquake and its after-shocks, it would seem theoretically that the next great seismic event was more likely to occur at some other place, and that successive great events would be distributed with a sort of alternation through the district. This hypothesis I used twenty-five years ago in predicting that the next slip on the fault at the base of the Wasatch range, instead of occurring in the locality of the last previous slip, would take place at a different point; and it has been more recently applied by Omori, Hayes, and Lawson in forecasting earthquakes on the western coast of the two Americas. These geographers agree in regarding the entire coast either as a single seismic district or as a portion of a greater district, in which there is interdependence of parts. Omori pointed out that in the period of six years from 1899 to 1905 there were extensive disturbances in Alaska, Mexico, Central America, Colombia, and Ecuador; he stated that the gap thus left between Alaska and Mexico had led him to anticipate an early rupture in that tract of coast; and suggested, after his first anticipation had been realized by the San Francisco earthquake, that the next disturbance might be south of the equator—where the Valparaiso earthquake soon afterward occurred. Hayes, after the San Francisco and Valparaiso earthquakes, suggested Mexico as a probable locality for the next rupture; and after the earthquake which devastated the State of Guerrero, in southern Mexico, made a similar suggestion as to Colombia. Lawson mentioned breaks in the continuity of recent demonstrations, between the southern part of California and Central America, and between the northern part of California and Alaska, and suggested the probability of early visitations in Mexico and the Oregon-Washington region. In this forecast he anticipated by a few weeks the Guerrero earthquake. Omori went farther and expressed the opinion that the Valparaiso earthquake was the final term of a series, and that the whole Pacific coast of America would be exempt for a time from *great* seismic activity. He expected for San Francisco a period of immunity of thirty to fifty years, and for coastal regions from Alaska to Ecuador of twenty to thirty years.

It will be observed that this idea of a series, breaking on the American coast in the course of a few years, and followed by a comparatively long interval before the arrival of another series, an idea apparently shared by Hayes and Lawson, combines rhythm with alternation in the theory of forecasting.

Prediction and verification are the test of hypothesis, and this group of predictions, embodying the diverse views of independent investigators, who approach the subject from both seismologic and geologic sides, constitute a valuable contribution to seismic forecasting.

Trigger.—The third general principle applicable to prediction is that of the trigger, or the straw that broke the camel's back. As the growing earth stress little by little approaches the limit of the resisting force, there is a critical period during which a relatively small additional stress arising from some other source may precipitate the catastrophe.

The principal known causes of periodic variation of stress are bodily tides of the earth; oceanic tides, which alternately load and unload the sea-bed near the shore; the winter load of snow on parts of the land; annual and diurnal variations of atmospheric pressure; diurnal variations of barometric gradient; and the wandering of the earth's axis of rotation. The relative importance of the several influences can not yet be indicated, but it is known that their absolute importance is not the same in all places. Three belong to the coastal belts, two to the land; and two belong to land and sea, but vary in latitude. Their relative importance in any particular locality may depend also on the direction of the slowly growing tectonic stress of the crust; for in order to be effective the temporary or adventitious stresses must be of such character as to augment the tectonic stresses. Let me illustrate this point.

The tidal sway of an oceanic basin raises and lowers the surface very little where the water is deep, but has a much greater effect on the shoals bordering coasts. The strip of sea-bed following the coast is subjected twice a day to the addition of a heavy load of water, and in the intervening hours is relieved of pressure by the same amount. On the seaward side of the strip there is a gradual change in pressure, and on the landward side, just at the water's edge, an abrupt change; and these pressure differences cause strains and stresses in the crust beneath. The directions of the induced strains lie in vertical planes at right angles to the coast, and are competent to increase or diminish tectonic stresses having similar directions. On the coast of Alaska near Mt. St. Elias the tectonic changes in progress include an uplift of mountains parallel to the coast, and the main tectonic stresses may be assumed to lie in vertical planes normal to the coast; so that here the oceanic tides are competent to precipitate earthquakes. But on the California coast near San Francisco, where the directions of the main tectonic stresses are horizontal and are approximately parallel to the coast, the stresses from oceanic tides may be ineffective. On the other hand, the stresses created in the crust by the shifting of the axis of rotation are probably better calculated to augment tectonic stresses at San Francisco than at Mt. St. Elias.

The most potent of all precipitants of earthquakes is also useless to the forecaster, because its action is unforeseen. It is the earthquake wave emanating from a near-by focus. The response to such an impulse follows the initial shock so closely that the two shocks are combined in a single seismic event—an earthquake with two foci, or a 'double earthquake'.

Prelude.—The forecasting of earthquakes by means

of prelude has nothing in common with other methods, but resembles rather the forecasting of the weather for the day by a glance at the sky in the morning. It depends on the recognition of premonitory signs, and also, to some extent, on the recognition of the earliest phases of the event itself.

When a fracture or other parting of the rock takes place, the jar which is communicated to surrounding portions of the crust is not a simple impulse, but a congeries of vibrations differing in amplitude and period, and in speed of transmission. At any point of the focus they begin together, but, traveling through the rock at different rates, they arrive at any distant point at different times; and the greater the distance the greater their separation. The strongest of the vibrations, or those said to constitute the principal shock, are not the first to arrive, but are preceded by vibrations which are much weaker, and are known as the preliminary tremors. At a point twenty miles from the origin the preliminary tremors are felt four or five seconds before the principal shock. There are also vibrations too minute to be felt, and not yet recorded by the most delicate seismographs, but of such frequency that they fall within the register of the ear and are preceived as sounds, and these usually begin to arrive before the preliminary tremors. The sounds and faint tremors are notes of warning, and to him who not only hears and feels but understands, they give command of precious seconds. People who live in earthquake countries and are familiar with these warnings acquire the habit of instantly taking precautionary measures.

Still earlier than the sounds and tremors with which the earthquake begins, are sometimes sounds, tremors, or minor shocks, and it is suspected that phenomena of this sort may betray growing seismic activity and thus constitute premonitory symptoms of the final rupture. Little is known of them in any exact way, because they occur at a time when attention is not directed to such matters; and nearly all records are made from memory after the occurrence of the earthquake. If they are veritable preludes, connected in a systematic way with the mechanics of the earthquake, they are probably analogous to the cracklings and crepitations observed in strained beams and strained blocks of rock before collapse occurs. With reference to the possibilities of forecasting, expectation centres especially on faint tremors such as are occasionally perceived a few minutes or a few hours before an earthquake shock. They are more frequently inferred from the peculiar behavior of animals; and after making much allowance for the influence of imagination on the memory of observers, there is still reason to think that various animals are affected by vibrations to which man is insensible, and that their reported uneasiness before earthquake shocks is real, and is occasioned by premonitory vibrations.

Summarizing briefly, many of the malloseismic districts or areas of earthquake danger are known from records of past experience, and others are being recognized by physiographic characters. Within them are tracts of special instability because of the incoherence of the underlying formation, and these can be both characterized in general terms and locally mapped. The general relations of danger to place are so well understood that an early solution of their outstanding problems may be assumed. Of the relations of danger to time much less is known and there is less promise for the immediate future. The hypothesis of rhythmic recurrence has no sure support from observation, and is not in working order for either large or small areas. Its corollary of local immunity after local disaster is more alluring than safe. The allied hypothesis of alternation between parts of a district is being tested by a great example, but the verdict belongs to the future. The hypothesis of precipitation by accessory forces which are in large part periodic and foreknown, has a good status and is being developed on the statistical side. It promises to make the date of prediction more precise if ever the approximate time shall be achieved by other means. The hypothesis of an intelligible prelude has barely been broached and the means to test it are not yet in sight. In a word, the determination of danger districts and danger spots belongs to the past, the present, and the near future; the determination of times of danger belongs to the indefinite future.

It remains to draw the moral. In view of these facts as to forecasting, and of the further fact that we have in our land a district subject to strong earthquakes, there are duties to be recognized and policies to be advocated. It is the duty of investigators to develop the theory of local danger spots, to discover the foci of recurrent shocks, to develop the theory of earthquake-proof construction. It is the duty of engineers and architects so to adjust construction to the character of the ground that safety shall be secured. It should be the policy of communities in the earthquake district to recognize the danger and make provision against it.

The general fact of local danger spots, where the agitation during strong earthquakes is peculiarly violent, has long been familiar. It is known that they are commonly found in lowlands where the underlying formation is a deep deposit of alluvium or other unconsolidated material, and that such material, while it exaggerates the violence of great shocks, absorbs and quenches small ones. It is also known that the local phenomena are in some way connected with the transformation of earthquake waves in passing from elastic to inelastic material. But a mechanical theory of the phenomena is yet to be supplied. For economic, as well as scientific purposes, this is one of the important fields for investigation. In Japan, where earthquakes are much more frequent than in any portion of our own land, the subject has been studied and may still advantageously be studied, by the observation of natural shocks. In America the problem can be more readily studied by means of artificial earthquakes in the laboratory, continuing the line of experimentation begun by Rogers. When the underlying principles have become known, it will be comparatively easy for geologists, engineers, and architects to estimate the danger factor in places to be occupied by buildings.

MINERAL RESOURCES OF UTAH.

By Robert H. Bradford.

*In the production of the four important metals, lead, silver, gold, and copper, in the year 1907, Utah stood third in lead, third in silver, fourth in gold, and fourth in copper, among the States of the Union. Her copper output for 1908 will be far in advance of last year, with the promise of greater increase, due to the rapid development of mining at Bingham.

The Utah Copper Co. owns about 200 acres of ground in the heart of Bingham, besides 1000 acres near the mouth of Bingham canyon, and 2400 acres at Oatfield. The orebodies of the property in central Bingham consist of an altered silicious porphyry containing small grains of copper minerals uniformly disseminated through the mass, both in fracture seams and in the body of the rock. The ore averages about 2% copper, 0.15 oz. silver, and 0.015 oz. gold. The primary copper mineral is chalcopyrite, but as a result of secondary enrichment from above, practically all of the copper sulphide minerals are now present, the principal one being chalcocite. The developed area covers 72 acres of ground, and although the thickness of the orebody has not been fully determined, developments show an average depth of at least 310 ft. This area and depth of ore figures up to the equivalent of 1,000,000 tons of ore per acre. Besides these 72 acres now developed or partly developed, there are 88 additional acres of mineralized porphyry in the company's property. Open-cut work with steam-shovels is employed in the extraction of 80% of the tonnage of 6000 or 7000 tons of ore per day, the remaining 20% being taken out by the underground caving system. At the mine the company has in operation 15 steam locomotives, most of 100,000 lb. weight; 125 dump-cars of 6 cubic yards capacity, used for stripping overburden; two 40,000-lb. electric locomotives; three smaller electric locomotives, and the necessary cars for underground haulage; 6 steam-shovels; about 10 miles of standard-gauge railway laid with 65-lb. rails; a 300-hp. compressor plant; a completely equipped machine shop, capable of repairing the heavy locomotives and steam-shovels; besides commodious offices and quarters for employees. About 75% of the ore produced by the caving system is transported by the Copper Belt railroad to the Utah Copper Co.'s concentrating mill at Copperton, about three miles down the canyon. The mill has a capacity of about 900 tons per day. It was built originally for the purpose of developing the best process of concentration, but has been trebled in its capacity, and now is an important unit in the company's commercial mills. The mammoth concentrating mill is at Garfield, where the company has an abundant supply of water.

The ore is transported 15 miles northward by the Rio Grande Western Railroad Co. to the Garfield mill, on the shores of the Great Salt Lake, and there concentrated, putting 22 tons of crude ore into one ton of concentrate.

*Abstract of a paper read before the American Mining Congress at Pittsburg, December, 1908.

The concentrate from the monzonite ore forms a desirable smelting mixture. It may be smelted direct in the reverberatory furnace, or roasted preliminary to smelting.

Adjoining the Utah Copper mine on the south is the Boston Consolidated. The Porphyry mine of this company covers about 156 acres. A large portion is underlaid by mineralized monzonite porphyry, similar to the Utah Copper ore, but running slightly lower in copper content. This is estimated by the company's engineers to average about 1.5%. The capping, or overburden, to be removed in order to mine the deposit by steam-shovel is about 100 ft. thick. The profitable ore over this area, as indicated by extensive equipment employed for stripping and disposal of the capping, and for the mining of ore



Map of Utah.

for the concentrating mill, has been in process of extraction for three years. This equipment is said to be ample for handling 15,000 tons of rock daily. The Boston Consolidated's concentrating mill is at Garfield, 15 miles in an air-line or 27 miles by railroad to the north. The mill will have a capacity for treating 3000 tons of prophyry ore per day. At present but eight units are in operation.

Besides the porphyry mine, this company operates an extensive sulphide mine covering 103 acres of the limestone belt. The ore carrying a high percentage of iron pyrite is not susceptible to concentration, but is sold to the smelter. The mine is fully equipped for the production of 750 to 1000 tons of ore per day by square-set stoping.

The Ohio Copper Co. adjoins the Utah Copper on the east, and the Boston Consolidated on the north, and covers an area of 120 acres. The ore is much shattered and broken. Copper is disseminated throughout the shattered rock, and especially along the cleavage planes in the form of a clean chalcocite,

associated with chalcopyrite and pyrite. Many crevices in the shattered quartzite have been filled by the metalliferous minerals, forming stringers and veinlets of rich copper sulphide.

From careful calculation of ore reserves there is estimated to be 13,500,000 tons of ore in the mine above the present transportation tunnel. The average copper content of the ore is 1.6 to 1.75% copper, with some 10c. in gold and 3c. in silver per ton. The concentration of this ore is a simple matter, as the copper minerals are not as finely disseminated through the rock as they are in the porphyry of the neighboring properties. The absence of any clay or talcose decomposition-products of the rock make this quartzite an exceedingly favorable ore for concentrating. The mill tests have given an extraction of 75 to 80%. A concentrating plant of 2400 tons daily capacity is now built at Lark, three miles to the east, for treating this quartzite.

The Highland Boy mine of the Utah Consolidated Co. was one of the early producers of the high-grade sulphide ores of the district. The ores of this company were smelted for a number of years at Murray, Salt Lake county. The ore averaged high in copper, and the output of the smelter in copper bullion was large in consideration of the ore-tonnage treated. The high-grade ore, and the favorable conditions for mining and smelting, were indicated by the dividends disbursed. These amounted to more than one million dollars per year. Since the closing of the Murray plant by the injunction obtained by the farmers of the valley, the ore has been treated at the American Smelting & Refining Co.'s plant at Garfield.

One of the large producers of the sulphide ores of Bingham is the Yampa mine. The ore is practically self-fluxing, but needs a small amount of limestone. The mine is delivering 700 to 800 tons of ore per day, which is transported about 1½ miles to the Yampa smelter, in Bingham canyon, the cost of transportation being seven cents per ton. The smelter treats the total tonnage of the mine, besides about 200 tons of custom ore daily.

The extensive properties in Bingham canyon owned by the United States Mining Co. are producing a large tonnage, that is all smelted at the United States smelter at Bingham Junction, in Salt Lake county. The ores are transported by an aerial tramway to the Rio Grande Western railroad at the Bingham terminus, and thence hauled to the smelter, 12 miles away.

Tintic has achieved and still holds the enviable distinction of having more dividend-paying mines than any other district in Utah. Eighteen of her mines are credited with having paid dividends of $17,000,000. The Centennial Eureka, one of the richest mines belonging to the United States Smelting & Refining Co., has of late years been the heaviest shipper. The Bullion Beck, one of the oldest producers in the district, has recently gone into the hands of the United States Co., and will be exploited more actively in the future. The Eureka Hill leasers have been active during recent years, and have produced large quantities of good ore. The Mammoth and Grand Central seem to show no limit to the depth at which they obtain profitable ore. East Tintic, upon Godiva mountain, has shown great activity during the last two years. The May Day and Uncle Sam have both benefited by the union they effected during 1907. During 1908 there have been paid out, by these companies, nearly $150,000 in dividends. The Knight properties, Crown Point and Iron Blossom, controlled by Jesse Knight, of Provo, Utah, have made a phenomenal record since their exploitations commenced three years ago. The Colorado has taken the lead by producing nearly a million dollars worth of ore in 1907 and paying an aggregate of nearly $800,000 in dividends during that year. The output averages from $75 to $100 per ton in lead, silver, and gold. The Beck Tunnel has been a close follower, with ore values averaging somewhat less, but with a total dividend-record near the $700,000 mark, but distributed over a considerable period of time. As evidenced by the miniature dumps at the shaft of these two mines there has been little dead work. Practically everything taken out has been shipping ore. The lime formation of East Tintic has responded so abundantly to the efforts of the miners that now a circle of dividend paying mines is found upon Godiva mountain, including the above mentioned properties, the Yankee Consolidated, the Gemini, the Sioux Consolidated, and others. Tintic suffered considerably by the closing down of the Salt Lake county smelters and a consequent cutting off of the market for ores. At present, since an amicable agreement between the farmers and the lead smelters has been entered into, relief has been furnished. Jesse Knight and his associates have organized the Tintic Smelting Co. and have started up during the present year a lead smelter of 350 tons capacity. This plant is in Tintic, and furnishes a ready outlet for the products of many nearby mines. Owing to the recent unfavorable metal market, this lead and silver camp for the first half of the present year marketed practically no ore. But during this period much development work was done, which opened up orebodies that made it possible for some of the largest companies to ship even better ore and a larger tonnage than ever as soon as metal prices improved.

The persistence of rich ore in the Park City mines as depth increases makes it important to provide proper drainage. The Ontario drain adit, 3 miles long, was constructed for this purpose. The caving of this adit a few years ago caused the lower levels of some of the large mines to become flooded. By intelligent and untiring effort this has, during the year, been re-opened. It has also been extended back under the Daly and Daly West mines. It will cut the Daly West shaft at the 2100-ft. level, giving this mine 600 ft. additional vertical depth. The Daly West main shaft is being deepened to meet the adit, and is now near the 1700-ft. level. The Silver King mine has made important discoveries of high-grade ore during recent development that puts it in possibly better condition than ever before. This mine, the Daly Judge, and the Daly West are shipping a fair tonnage. The new developments in the

Park City district have been made recently in Thaynes canyon, toward Brighton. Prospects showing great activity there are the Copper Apex, Keystone, Uintah Treasure Hill, New York, Wabash, and Silver King Consolidated.

Utah's famous gold producer, the Consolidated Mercur Gold Mines Co., is the leading gold-producer in the State. During the past 15 years many millions in gold have been taken from the properties of this company. The total dividends to date paid by the present company, and by the old De Lamar and Mercur companies, run up to the handsome sum of $3,385,312. This amount shows the success that has attended the persistent efforts of John Dern and his associates. The Boston Sunshine Gold Mining Co. has re-constructed the mill of the old Sunshine mine of Mercur, and is adding new equipment preparatory to cyaniding the argillaceous, refractory ores of the once famous Sunshine mine. The mill will have a capacity of 200 tons per day, and will be put into commission during the month of January. Other important mining districts of the State are: Alta, Big Cottonwood, American Fork, Deep Creek, Beaver County, Kimberly, Park Valley, and Gold Springs.

The State also yields many valuable non-metallic minerals. The waters of the Great Salt Lake are furnishing yearly about 40,000 tons of salt, supplying most of the States west of the Missouri river. The saturated brine of this great body of salt water contains an almost unlimited supply of the mineral so essential to human life. There has recently been explored an immense salt bed in the Great American desert, about 110 miles west of Salt Lake City, 15 miles east of the Utah-Nevada State line. The Western Pacific railroad has built directly through these beds. This salt covers an area of 60 square miles. The deposit varies in depth from 6 in. to 7 ft. or more. It is almost perfectly white, and absolutely free from dirt, rubbish, or growth of any kind. The United States Congress, by the provisions of the Enabling Act for Utah, gave to the University of Utah all the saline lands of the State. Notwithstanding this fact, prospectors have staked their claims over the deposit, and are contesting the University's rights in the courts. The Supreme Court of Utah during the past week gave its decision in favor of the State University, but the case may not be finally disposed of until the United States Supreme Court renders its decision.

There are four extensive coalfields being operated at present in the State of Utah. These include the Book Cliffs, the Weber River, the San Pete, and the Iron County fields.

The asphalt deposits of eastern Utah are world-famous for their extent and purity. The principal minerals consist of uintahite, wurtzillite, elaterite, ozocerite, and maltha, besides a variety of asphaltic limestones, sandstones, and shales. Uintahite, or the gilsonite of commerce, is the most important. It occurs in true veins cutting the sedimentary rocks of the region. In extent and purity these deposits far surpass any others now known.

Other mineral deposits of great value in the State include fire-clay, gypsum, phosphate, ornamental stones, uranium, vanadium, and radium minerals that up to date have been but partly developed, and there are notable beds of iron ore. The iron deposit in Iron county, in southern Utah, occurs as a mountain of ore, 15 miles long and 3 miles wide. Hundreds of acres of this mountain of ore will require no stripping, and in greater part it will respond readily to the steam-shovel. Analyses of numerous samples by the United States Geological Survey show from 59 to 65% metallic iron.

The smelters now available in Utah, with their capacities, are as follows:

	Tons Daily.
Murray plant, American Smelting & Refining Co., lead	1,500
Garfield plant, American Smelting & Refining Co., copper	3,000
U. S. Smelting Co., Bingham Junction, copper.	1,500
U. S. Smelting Co., Bingham Junction, lead...	1,000
Yampa smelter, Bingham canyon, copper.....	1,000
Utah Smelting Co., Ogden, copper.....	250
Tintic Smelting Co., Tintic, lead.....	350
Tintic Smelting Co., Tintic, copper.....	150
Total	8,750

FINK COPPER SMELTING PROCESS.

At 10 o'clock Saturday night, January 16, the first pouring of blister copper ever made in a single process furnace was accomplished at the Edward Fink plant, at Garfield, Utah, near the Boston Consolidated mill. With 15 men on a shift, and with the utilization of 25 hp. and a couple of tons of fuel, the Fink smelter has demonstrated its ability to convert Boston Consolidated concentrate into copper matte at the rate of 100 tons per day.

In the Fink plant 95 to 98% copper matte is produced at the one operation. Nothing like it was ever accomplished, and some of the best metallurgists and expert smeltermen in the business have doubted whether Edward Fink would accomplish it in a commercial way. Samuel Newhouse, daring and progressive in all that pertains to mining, was approached by Mr. Fink, and heard from him the details of the scheme. It appealed to him as having merit, so he made an agreement with Mr. Fink to bring the process to the attention of the world. He gave the inventor carte blanche in having an experimental furnace of commercial size built, one that would treat 100 tons per day.

At the trial run, in less than one hour after the ore was fed, the molten matte was allowed to run into the pots. One bar was run out into a flat mold, and the sample, weighing possibly 150 pounds, was taken to Salt Lake City.

The process consists in reducing copper concentrate directly in a revolving barrel-shaped 'converter', so-called. Gas and pre-heated air are blown in at one end, and the direction of the flame may be reversed at will, as with furnaces using regenerative chambers. Through the ports at each end of the barrel inclined tuyeres extend down into the charge. As soon as the charge has become molten the tuyeres are lowered and desulphurization and oxidation of iron proceed until a highly enriched matte is produced.

PROTECTION OF INVESTORS.

The second meeting of the Pacific Coast division of the Mining and Metallurgical Society of America was held in San Francisco on December 19, the discussion of the previous meeting being continued, as follows:

S. B. Christy.—At our last meeting Mr. Bradley opened the discussion, insisting on the idea that reports issued by mining companies should state the amount of developed ore, the amount of ore that was probable, and the amount of ore that was possible, both in tonnage and in average value. The general consensus of opinion was that the nature of the evidence on which a judgment was based should also be given. The question is: "What are the essential items of information which should be contained in mine reports for the full protection of investors?" We have agreed that the report of the management should give a clear and definite statement of the amount of ore exposed and ready for stoping, and that it should be indicated on what basis the estimate was made. It is evident that other items are required.

F. W. Bradley.—I would suggest that in addition to the physical value of the property, there should be a clear statement as to the financial conditions. This is something that is not often clearly set forth in a report. We touched on just one item at our last meeting, namely, the question of ore reserves, which in my opinion is more important than anything else; but there are other items that should be discussed, although I do not know that we have yet finished the question of physical valuation.

W. H. Shockley.—Some mines never have any ore reserves. It seems to me that Professor Munroe has summed the thing up so well that there is not much more to be said. The question is how much money you can make out of the ore.

M. L. Requa.—I think Professor Munroe has laid too much stress on the time that a mine is likely to last. Of course, it is hopeless to attempt to safeguard the public in the preliminary stage of mining development. We all know that the unexpected often happens and we may run into bonanza or into borrasca; but after that there comes a stage when you can give some definite figures on vital points; and while it is desirable to have the report go into details as to the cost and how those costs were arrived at, yet, following that, for the benefit of the layman, I think that a concise statement, based upon those detailed figures, is much more interesting to the average investor than the mere recital of the various items that go to make up the cost.

T. A. Rickard.—Munroe goes into that by saying that he wants it determined by some competent man.

M. L. Requa.—That is a very broad question. It can be boiled down by taking the figures in detail and compiling from that the ore actually developed and ready for stoping; this should be segregated in a paragraph by itself, giving the tonnage, the assay-value, the extraction, and finally the net value of the ore applicable to dividends—*that* is what the shareholder wants to know.

W. H. Shockley.—And how long those dividends will continue.

M. L. Requa.—That depends entirely upon the size of the plant; it should be stated in the report what tonnage you can work annually. Following that, in a separate paragraph, I would include a statement of partly developed ore, carrying out exactly the same set of figures as to the net value to be won, available for dividends, and reducing that right down to dollars per share of capital stock. Then, a third item giving the probable extension of the orebodies as yet undeveloped on the levels above the bottom, with the same tabulation. And finally a statement as to the bottom of the mine. The personality of the mine manager becomes a large factor, as to what he can consistently say regarding the probable future life of the mine, the possible depth to which the pay-ore will continue—this, while it cannot be expressed in actual dollars, has a direct bearing upon the ultimate value of the stock. I noticed in reading Professor Munroe's remarks that he laid considerable stress upon the life of the mine. Some mines, notably in the State of Nevada, are possibly short-lived; yet they produce an enormous amount of money applicable to dividends, and a statement regarding the probable length of the life of the mine would be misleading unless coupled with some information as to the probable amount of money to be derived during that period. There are certain statements that you can make positively, and others that you cannot. It might be possible to compel mining companies under a State law to render reports upon certain fixed lines that would largely embrace all the necessary information.

W. H. Shockley.—I do not see why it could not be done.

Charles Butters.—The element of chance makes it impossible to establish any fixed rule; you may tell a man definitely what he will receive upon his investment, but that element of doubt remains, particularly in Nevada, for tomorrow or the next day you may run into a bonanza that will smash all your calculations.

T. A. Rickard.—The average investor would like to know whether the stock is going up. He does not care about the mine.

S. B. Christy.—I think that is true everywhere.

Charles Butters.—That is not true in England as regards South African stocks.

S. B. Christy.—The English take a different view about matters of that sort. It is partly a sentimental view. Many of my friends who have been in Rhodesia have told me that the English are willing to spend money freely without any hope of return simply for the reason that they want to develop the country. They have the instinct for land-grabbing, and they feel it their duty to develop the country so that future generations may benefit by it—sow the seeds of Empire—that idea is strongly developed.

W. H. Shockley.—I have attended a good many meetings of mining companies in London, but I never heard anything about the Empire; the talk was all of profit and loss. The essential things to know are: the number of shares of stock, how much will be paid

in dividends, the length of time it will take to work out the mine, and the value of the improvements, buildings, machinery, and material on hand when the mine is exhausted. From these data the investor could value the shares of the company. The dividend-value of the ore is always an uncertain quantity; there is usually a certain amount of ore that is developed, and as to the amount of which two engineers would agree; besides this there are apt to be possibilities for ore which would be differently estimated by equally able engineers. These possibilities should be reduced to definite figures; so much in dividends per share. Thus one could do a good deal of theorizing as to the possibilities in depth or laterally. But eventually, in almost all the precious-metal mines, you have got to do a good deal of guesswork. It is not like a bank statement. Take men who are perfectly expert in the business, who have had the same experience, and yet they will arrive at widely different conclusions. It is largely a matter of judgment. You must do as they do in New Jersey when they weigh sheep. They put the sheep on the end of a rail and balance the rail on a fence and put a sack of stones on the other end, adding or taking away from the stones, and when they get the rail balanced, they estimate the weight of the stones. And there is a good deal of that same thing that has to be done in mining. Again, mining is looked on by almost everybody as a means of gambling, like race-horses or a faro-table. A man buys shares on the theory that they are going up, and he is going to sell them when they advance. Of real investment in precious metal mines I have not seen very much. A great many people have been misled of course, especially Eastern people, by statements that have been issued by promoting concerns. Take the Sullivan Trust Company at Goldfield. The amount of money they got out of the investing public was enormous. At one time I understand there was $100,000 per day paid in to them; and the statements as to the value of their mines were absolutely false in most cases. There should be some means of having such statements corrected as soon as they are made, by some competent authority. I do not know how you are going to get at it exactly—government experts, perhaps.

F. W. Bradley.—It is often difficult to learn from reports whether a company has money on hand or is in debt; the financial conditions should be clearly set forth, as Professor Christy suggested. As regards costs, I think Mr. Comstock handled that in good shape. Rather than have a mass of details, the ordinary shareholder would prefer to know the lump cost of principal items and a comparison by years in order to determine whether the costs are increasing or diminishing.

C. C. Derby.—Would you make any segregation of costs?

F. W. Bradley.—That also was covered in Mr. Comstock's paper. It is well enough to have the complete details in arriving at lump costs, but in presenting them to the ordinary shareholder, he should not be bothered with too much detail. It is more to the point for him to have the totals of the principal items, so that he may know by comparison whether those items, per unit or per ton, are increasing or decreasing.

T. A. Rickard.—Our guest, Mr. Erb, is the secretary of the Mine Operators' Association of Goldfield, I believe, and it occurs to me that being a man who is closely in touch with the practice in that district, he may be able to give us some interesting information.

William Erb.—Anything I may say will be purely an offhand statement. When the cold calculating business-man is considering a venture, he looks at the men at the head of it. A mine may be worth as much today as a year hence; but today it is manned and managed by a man not competent; you have nothing to do with it; a year hence it has passed into the hands of a man who has your complete confidence, and by reason of that confidence the shares advance.

T. A. Rickard.—All the difference between Sullivan and Mackenzie?

William Erb.—Exactly; that is the story in a nutshell. In each instance you have to differentiate between a mine and a prospect. When you have got a mine it is not at all difficult to get people who know, to come into it on the point of dividend returns. But when you have a prospect, or something between a prospect and a mine, you will always have people who want to gamble, and they will not gamble on what the mine is; they are going to gamble on the personality of the man that presents it to them. The Sullivan Trust Co. affair was one of the cleverest advertising schemes in the world, putting out alluring prospects of returns of ten thousand to one. Every day in my mail came in letters, "You in your capacity are undoubtedly acquainted with such and such a mine." I never heard of the mine, and never heard of the people connected with it. These letters were written by my own friends in San Francisco, reputable business-men. They would write and ask: "Have you heard of this mine?" I had not. But if I went to those men and said: "I have 8 ft. of $200 ore, and if you put your money into the mine, you will get 40 cents per annum for every dollar you invest for 10 years to come," they would be incredulous. Yet they will invest in a prospect that is put to them in an alluring sort of way.

T. A. Rickard.—Could you suggest some way of protecting these innocent people?

William Erb.—No, I cannot. The story dates back to the time when a man had a number of sons and the name of one of them was Joseph. He was a better man than his brothers, and because he could get on the better side of his father, they lowered him into a well. But he finally got into a good country, and there proved himself to be the better man after all.

S. B. Christy.—It seems to me a hopeless task to try to protect a certain class of people; there always will be one class preying on another. We are interested in the general welfare of the whole industry. I think a certain amount of foolishness is inevitable. I believe that certain kinds of mines would not be developed were it not for this speculative instinct.

If it were all a cold-blooded proposition there are lots of mines that would never be opened at all. But we all feel that there should be some distinction in reports between what is reasonably certain and what is chance. Of course if people go into a proposition that is distinctly a chance, they should not squeal. And it is fortunate that some men are willing to lose, for it results in the development of legitimate mines.

C. W. Merrill.—Is not the question under discussion the protection of the investor, rather than the protection of the speculator? It seems to me that the developed property has to do with the investor.

S. B. Christy.—There is a good deal of money invested in Nevada that comes from speculation, and some of it is used to good advantage.

C. W. Merrill.—Of course, I am more of a metallurgist than a miner, but it seems to me that in connection with a well developed property it ought to be possible to establish a form for reports such as Mr. Bradley and Mr. Requa have suggested, and it need not be particularly complicated; but in the valuation of the mine, the dividends that can be produced from the ore in reserve, the possibility of reduction in operating cost should be stated fully and also the possibility of increased extraction—these matters should appear in each report as the matters suggest themselves and as the development continues. It seems to me that when that is done we shall have covered the matter fairly well. Let it be done in a concise and definite way. The question of possible ore reserves is interesting, but it is problematical. If we state what ore is in reserve and what it will cost to get the values out of it, what the chances are for improvement and reduction in cost and increase in yield—that is what the mining investor ought to be told. Possibly a model of such a report would be a good thing, and if it were possible to make it compulsory, so much the better. But I do not think, as Mr. Comstock said, it is going to be possible to do it by State regulation.

Albert Burch.—I do not believe that it is possible to make it compulsory. You can provide a penalty for publishing a falsehood in connection with a mine, but you cannot pass a law compelling the issuing of reports which will really be of any value, if the officers care to evade the law in the matter of making such reports. Take, for instance, the weekly reports that come down from the superintendents on the Comstock. They have to state certain facts, and those reports state the truth; but they state the truth in such a way as to conceal the information that they are really intended to give. For example, a drift is reported to have been run so many feet in a certain week; the face of the drift is in porphyry. The controllers of the mine have in mind a depression of the stock with a view to buying it and later selling it at an advance. They are driving that drift right alongside of a body of ore and know it, for they drive drill-holes into the ore and know it is there. Later on they can publish an account of a great strike; then the public will learn what the management has known all along. You cannot compel a man to make a report stating the facts unless the people who know it want it published. But you can punish for false reports, and it seems to me that it is toward that point that State regulation should be directed, and let the really affirmative part of the reform come in the shape of setting good examples, voluntarily.

Whitman Symmes.—I would like to make one suggestion, namely, that most mining companies should make fuller statements as to how their money has been expended. Scattered over Nevada, and elsewhere, are many companies that have taken the public's money, and have appropriated only a small portion of it to the development of the mine. It seems to me that if a form were made out upon which these companies had to state how their moneys were expended, a great many of them would not dare to go on in the way they have been traveling. For instance, if their expenses were segregated into power and pumping, shaft sinking, driving of drifts, extraction and reduction of ore, new plant, salaries, and office expense, it would stop a great deal of wastefulness. It is not enough for us to recommend that companies report the amount of ore developed and partly developed; the expenditures at the mine should be segregated so as to properly explain what is being done with the money. I believe that the first step taken by any of us here, when looking into the management of a mining company, should be to segregate the expenditures so as to ascertain the different items that I have mentioned. We would try to find out what the men in charge were doing with the money they were expending, and then we would pass judgment quickly as to whether the mine were being honestly run or not. In regard to writing a report that will be intelligible to the general public, I must say that I do not think such a thing is possible, because the general public is not versed in mining. When a man applies to the United States Government for a patent upon an invention, there are certain specifications describing that invention which the applicant has to place on file. The Government does not require that the specifications shall be so worded as to be intelligible to the ordinary person, but that it shall be so worded as to be intelligible to 'one skilled in the art'. It seems to me that a mining report should be framed in a similar manner, so that it will be intelligible to one skilled in the art of mining. If that be done, it will then be easy for an investor to take the report to one versed in mining, and to find out from the latter the pros and cons that are disclosed by the report. If he does not do so, the fault is then all his own.

(*To be Continued.*)

Lime slaked with hot water, according to Leo D. Bishop, causes slime to settle with nearly twice the rapidity of lime slaked with cold water. Mr. Bishop also calls attention to the great difference in effectiveness of different limes as coagulators for slime. The composition, as well as the perfection of burning, are important. In short, the more CaO the lime contains, the more it is worth.

The Treadwell mines, on Douglas island, Alaska, showed a notable increase in gold production, the output for the year 1908 having been $3,081,454, against $2,515,098 in 1907.

PROGRESS IN ALASKA.

By Alfred H. Brooks.

The value of the mineral production in Alaska for 1908 is estimated at $19,600,000, as compared with $20,871,771 for 1907. This decrease is to be charged to the gold placers and copper mines, as most of the other mining industries show an increase in value of output. The value of the total mineral production from 1880, when mining first began, to the close of 1908 is, in round numbers, $148,000,000. Of this amount the gold mines have produced about $142,000,000, the silver output is valued at $1,150,000, and the copper at $4,100,000. The balance represents the value of the marble, gypsum, tin, and coal product.

Measured either in terms of production or of work accomplished, 1908 was not a prosperous year for the mining industry of Alaska as a whole. The causes that brought about this retardation were in part those affecting the mining industry everywhere; in part they were due to conditions peculiar to the North.

Mining, like many other industries, was seriously affected by the business stagnation that followed the financial panic, and the concomitant fall in the price of copper led both to a decrease in the output of that metal and to a diminution of activity in the preparations for future extraction.

Gold placer mining experienced a decided setback because of the drought that prevailed throughout the summer months in nearly all the important districts. The lack of water so curtailed the output of the Yukon and Seward Peninsula districts that the value of the total output of placer gold from these sources was probably nearly a million and a half less than in 1907. This decrease of the placer-gold production for Alaska as a whole is, however, but temporary, for the maximum annual output of the gold-bearing gravels has not yet been reached.

In spite of the business depression, the production of the auriferous lode mines of Alaska was about 27% greater than in 1907.

Among the conditions that are retarding the advancement of the mineral industry are the inadequacy of the public-land laws under which placer ground is acquired and held, and the impossibility of obtaining title to coal lands.

Improved transportation facilities are among the most urgent needs of the region. Much progress was made during 1908 in the construction of wagon-roads and trails, but these can only supplement and not supplant railways. The inadequacy of river transportation in seasons of low water was emphasized by the conditions on the Yukon last summer.

The advancement of several railways, such as those to the Matanuska coalfields and to the inland copper districts, from both Valdez and Katalla, which had been actively pushed during 1907, was greatly retarded by the financial conditions. In gratifying contrast to the slow headway made by these enterprises was the rapid progress of a railway being built up Copper river from Cordova. This line was completed to Childs glacier in September. In connection with this road steamers are to be run from Abercrombie rapids, so that during the coming year it will be possible to avoid the long overland journey from the coast to reach the Chitina copper belt. As the railways in Alaska are of much public interest at present, the following table of mileage has been compiled from the best data available:

MILEAGE AND TERMINALS OF ALASKA RAILWAYS, DECEMBER 4, 1908.

	Miles.
Seward Peninsula:	
Seward Peninsula Ry., Nome to Shelton	80
Paystreak Branch S. P. Ry.	6.5
Council City & Solomon River, Council to Penelope Creek	32.5
Wild Goose Ry., Council to Ophir Creek	5
Fairbanks:	
Tanana Valley R. R., Fairbanks and Chena to Chatanika	46
Kenai Peninsula:	
Alaska Central R. R., Seward to near head of Turnagain Arm	53
Copper River:	
Copper River R. R., Cordova to Childs Glacier	58
White Pass:	
White Pass & Yukon R. R., Skagway to White Pass (Terminal at White Horse, Yukon Territory.)	20.4
Yakutat Bay:	
Yakutat Southern Ry., Yakutat to Situk River	9

Portions of the Council City & Solomon River and of the Alaska Central are out of repair and not in use.

The following table indicates the source of the precious metals. The value of copper is estimated at 13.2 cents per pound.

SOURCE OF GOLD, SILVER, AND COPPER IN ALASKA IN 1908.

	Gold.	Silver.	Copper.
Silicious ore	$ 3,525,000	$20,000	.....
Copper ore	75,000	25,000	$634,000
Placers	15,000,000	35,000	.....
	$18,600,000	$80,000	$634,000

Twelve gold and silver lode mines were on a productive basis in 1908, as compared with 13 in 1907. The number of placer mines operated cannot be stated, but there were not so many as in 1907. Nine copper mines made some shipments of ore, as compared with 13 in 1907.

The tonnage of all the lode mines in Alaska for 1908 is estimated to have been between 1,650,000 and 1,700,000 short tons, as compared with 1,308,506 short tons for 1907. Of this amount, about 1,550,000 to 1,600,000 short tons represent the silicious gold ore and the balance the copper ore. The valuable contents of the ores mined will not be known definitely until accurate statistics are available, but they probably do not differ materially from those of last year, which showed an average gold content for the silicious ores of $2.30 per ton including the Treadwell, and $3.41 per ton excluding the Treadwell.

The copper ores in 1907 yielded an average of $1.30 per ton for gold and silver, and 3.18% copper. It is probable that the copper percentage for 1908 has been slightly increased, as with the low price of copper only high-grade ores could be profitably mined and shipped. It is estimated that the copper production of Alaska in 1908 was about 4,800,000 lb., as compared with 6,308,786 in 1907. Of the 1908 production, somewhat over 1,000,000 lb. should be credited to Prince William Sound and the rest to the

Kasaan Peninsula and Copper Mountain districts of Prince of Wales Island. Considering the low price of copper during 1908, this output is exceedingly creditable, and indicates that the coastal mines are in a position to produce this metal at a low cost.

The statistical data for the placer mines are yet incomplete, but it appears that the output has a total value for 1908 of somewhat over $15,000,000, as compared with $16,491,000 in 1907. This decrease is chargeable to the adverse conditions of mining because of the scant water supply in the Yukon and Seward Peninsula districts. Had there not been this shortage of water, the placer-gold output would have far exceeded that of 1907.

Though the decreased output was due to the lack of water, yet it can not be denied that the approaching exhaustion of some of the bonanzas, such as the third beach line at Nome and parts of the developed channels at Fairbanks, would have much curtailed production had not other similar rich deposits been found. Placer mining in Alaska up to the present time has been largely a matter of taking the cream of some of the richest deposits, and even this often at an almost prohibitive cost. It has been chiefly in the hands of the pioneer, who often may have neither the patience, the capital, nor the experience to exploit anything but the bonanzas. Throughout Alaska there are few well-managed enterprises endeavoring to recover the gold from the larger bodies of low-grade alluvium. Until a change is brought about in the mining conditions it must be expected that there will be marked fluctuations in the gravel-mining industry—an advance with the discovery of new rich deposits, a retrogression as quickly as these are mined out. With the advent of capital and skilled engineers, methods will be improved, the many large bodies of gravel having smaller gold contents will be exploited, and the industry will be placed on a more stable basis. The whole future of the industry depends on this economic revolution, and the quicker the change is brought about the less likelihood is there of a long period of stagnation after the richest deposits have become exhausted. This conclusion does not imply the improbability of other discoveries of the same grade as those that have made the country famous; it only emphasizes the fact that permanent industrial advance can not be founded on bonanza mining.

The summer of 1908 brought convincing proof that the water supply in most of the placer camps is inadequate for the needs of the placer miner. With a precipitation of 10 to 16 inches in the Yukon basin and 15 to 30 in. in Seward Peninsula, the climate must be considered semi-arid. Moreover, the frozen condition of the subsoil prevents any ground storage, and the low stream-gradients are unfavorable to the utilization of the water-supply. All these factors go to show the inadequacy of the surface waters to the needs of the placer miner—an inadequacy that is emphasized by such dry seasons as those of 1907 and 1908. Unfortunately the operators, slow to recognize this, have been only too ready to regard some of the years of heavy precipitation as normal, and many of those of low or moderate precipitation as abnormal. Many hundreds of miles of ditches have been constructed, or partly constructed, and many expensive plants installed for which the normal water-supply was absolutely inadequate. The problem of mining the gravels with an inadequate water-supply presents many difficulties, but it will be solved. It is probable that power will be obtained for pumping and other purposes by utilizing water-power or the extensive deposits of lignitic coal found near some of the placers.

The introduction of dredges, both in the Yukon and Seward placers, is a promising feature of recent advancement, although here too the lack of experienced engineers or capital has worked havoc with many enterprises. Probably nearly a hundred dredges have been built in this northern region, and most of them have been utter failures, but there is, nevertheless, no question that the dredge is to play an important part in Alaskan mining operations in the future. In 1908, including those in the Klondike, nearly a score of dredges were successfully operated. The statement that there are large areas of dredging ground should not, however, be interpreted to mean, as it appears often to have been in the past, that any auriferous gravels which could not be mined by other means furnished suitable ground for dredge-mining. Frozen ground is a serious obstacle to dredging operations, but experiments in thawing by both natural and artificial means, now being made, will solve this difficult engineering problem.

The results of these operations and investigations are as yet far from conclusive. It appears, however, that where the ground is unfrozen, dredging can be done at a rate of from 12 to 40 cents per cubic yard. Thawing by artificial means can probably be done at a cost varying from 12 to 25c., while thawing by exposure to the air and with the aid of water is much cheaper. These figures apply to ground probably not exceeding 25 ft. deep. The maximum here presented (65 cents per yard) does not appear excessive to those familiar with the high cost of mining in most of the placer districts. Little of the gravel now handled at Fairbanks, where most of the mining is done at a depth of from 30 to 150 ft., carries less than $4 to $5 per yard in gold. Where ground is shallower, probably gold to the value of $3 to $4 per cubic yard can be profitably recovered.

One half of the natural gas now coming out of the earth, about 1,000,000,000 cu. ft. per day, or more than enough to light all the cities of the United States having more than 100,000 population, is wasted by being allowed to escape into the atmosphere. This entire waste can be prevented by adequate State legislation, similar to that now enforced in Indiana and one or two other States.

Diamonds are being produced in considerable quantity from the recently discovered Luderitzbuch field, in German Southwest Africa. The Weiss de Mellion Co. is producing from 12,000 to 15,000 carats per month. The bulk of the diamantiferous area has been acquired by three companies. The diamonds range mainly from a sixth to a third of a carat.

SINTERING AT CERRO DE PASCO.

*A special commission to report on the operations at Cerro de Pasco was appointed in 1907, and has continued its functions into the present year. Bulletin No. 61 is the fruit of its labors, containing a large amount of interesting data, from which is abtracted the following account of a system of ore-agglomeration, or sintering, which will be of interest in comparison with the Huntington-Heberlein, Dwight-Lloyd, and other sintering devices now offered as a substitute for briquetting in the preparation of fine material for blast-furnace smelting.

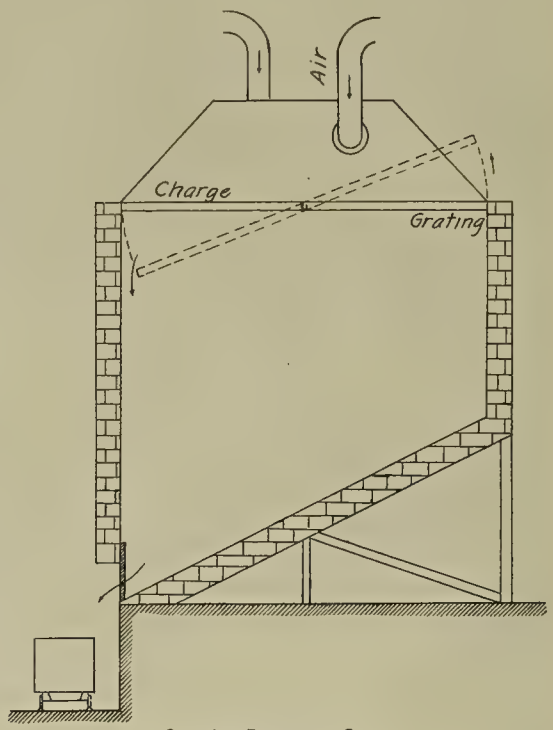
The Cerro de Pasco Mining Co. has recently installed 14 sintering furnaces at its smelting works at Tinyahuarco. In these ovens are agglomerated the fine ore passing the grizzlies, and the flue-dust from the condensing chambers at the smelter. A series of 10 hoppers, of which 5 are for fine ore and 5 for flue-dust, discharge upon an endless belt-conveyor 112 feet long by 22 in. wide. The mixture as it falls upon the belt is sprayed with water until it contains 10% moisture. The material thus dampened passes to a screw-conveyor, which serves both to mix the fine and the flue-dust, and automatically to feed the mixture to an elevator. The elevator discharges into a large hopper, whence the material is transported in cars to funnels which are placed above each oven. Alongside of these are other funnels for feeding limestone. The operation of the belt-conveyor and the elevator is effected by means of an electric motor rated at 50 kw., 400 volt, 60 cycle, 3 phase, 66.5 amp., running 850 rev. per minute.

The accompanying sketch will illustrate the construction of the sintering furnace or oven. It is composed essentially of two parts: an upper movable portion of iron, which actually constitutes the oven where the sintering is done; and a lower portion of brick-work. The upper part consists of a grating so suspended by a central axial bar that it may be rotated for convenience in discharging its burden. This grating has a superficial area of 124 sq. ft., and consists of three groups of bars, of quadrangular section, narrower above than below. The central portion also has somewhat larger bars than those on the sides. This grating is covered by a movable hood 3 ft. high. Into the upper part of the pyramidal hood are led two tubes for an air-blast, which is delivered at a pressure of 5 oz. To effect a seal against the escape of air, there is an asbestos packing between the bottom of the hood and the brick wall on which it rests.

The lower part of the furnace, corresponding in position and design to an ash-pit, serves as a bin for the agglomerated material. It is square, with a sloping bottom, as shown in the cut, so arranged as to dump into cars on a track below.

The operation is conducted as follows: upon the grating enough crushed limestone is drawn completely to fill the spaces between the bars, and thus form a bed, upon which is placed the mixture to be sintered. This is lightly raked over so as to be spread evenly. Upon this wood chips are thrown; these are kindled by means of hot coals drawn from a perambulator-hearth on wheels. The hood is then lowered and the air-blast turned on. Normally the operation lasts one hour. At times the bed lacks porosity, which causes the blast-pressure to channel the bed and fail to effect the roast. When agglomerated the hood is raised, and the grating revolved on its axis, dumping the charge into the bin below.

At the present time only 4 ovens are in service, which treat 30 tons each in 24 hours. The desulphurization effected is from 5 to 1, the average sulphur content of the original charge being 20%. The copper-content of the charge averages from 10 to 12%



Sintering Furnace or Oven.

in the fine ore and 14% in the flue-dust. The system cannot be said to be highly economical. The labor-costs are high, two men being employed for each furnace, on 8-hr. shifts. Losses and inefficient agglomeration result from failure to add just the correct quantity of water. Furthermore, the method of igniting the charge is poor and tedious, and adds extraneous matter to the charge. Efforts were made to ignite with petroleum, but this only served to augment the costs.

*Translated for the MINING AND SCIENTIFIC PRESS from a Report to the Peruvian Minister of Fomento.

Excavation on the Panama Canal is proceeding rapidly. Since the Government took up the work, from May 4, 1904, to the close of 1908, 59,773,179 cu. yd. has been excavated, of which 37,016,693 cu. yd. was taken out during 1908. By the French companies 81,548,000 cu. yd. was excavated. From the appropriations for canal construction, the expenditures from May 14, 1904, to October 1, 1908, were $83,275,000. Of this amount $51,512,000 was expended by the Department of Construction and Engineering.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

ACTION TO RECOVER MINES—INJUNCTION.

In an action in ejectment to recover certain mining grounds the plaintiffs were entitled, under a statute giving an injunction where another is doing or threatening to do some act in violation of the plaintiff's rights and tending to render any judgment recovered ineffectual, to an injunction ancillary to the main action restraining the defendants from operating a mine on the ground in controversy, pending the action, on a showing that such ground was chiefly valuable for placer mining, and that the continued operation of the defendants thereon would result in irreparable injury to the plaintiffs.

Waskey *v.* McNaught, 163 Fed. 529, July, '08.

DUTY TO KEEP MINE REASONABLY SAFE.

The law as well as the Federal statutes impose upon an owner of a mine the duty of exercising reasonable care to see that the mine is in a reasonably safe condition for miners to work therein. The law does not impose upon the miner the duty of exercising care and prudence to discover the condition of the mine before beginning work. But if the mine is in such a defective or dangerous condition, which is so obvious to the eye of the miner at the time and place as to make it apparently dangerous to work there, and he voluntarily proceeds to work at such place and under such circumstances, without complaint, he assumes the risk and cannot recover in case of injury.

Bolen-Darnall Coal Co. *v.* Williams, 164 Fed. 665, Oct., '08.

LIABILITY FOR INJURIES TO SURFACE PROPERTY.

The owner and operator of coal mines was held liable in damages for the drying up of the wells of water of the owner and occupant of the surface lands, which resulted directly from the negligent operation of the mines. It was sufficiently shown that cracks and fissures in the surface lands, occurring at the time of the disappearance of the water in the well, were caused by the negligence of the owner of the mines in failing to properly and sufficiently timber and otherwise sufficiently support the roof of the mine.

Sloss-Sheffield Steel & Iron Co. *v.* House, (Ala.) 47 South. 572, Nov., '08.

SALE OF MINERAL LANDS.

A contract for the sale of mineral lands provided for the payment of a large part of the purchase price from the profits of the mines; by the terms of the agreement the purchaser was to promptly install a reduction plant for the proper treatment of the ores of the mines, and for the diligent operation of such mines to secure the means for the prompt payment of the purchase price; it was expressly stipulated that six months was sufficient time to procure and put the plant in operation; but if by using reasonable diligence it could not be completed within that time, this should be no ground for rescission or damages. It was also agreed that $60,000 of the purchase price was to be applied to the payment of liens against the property, and the vendor was to furnish a list of all liens. In an action by the vendor to rescind the contract it was held that the vendee's delay of eleven months in installing the reduction plant was not excused because the vendor's title was defective as to an undivided one forty-eighth part of the property, but which defect was not known to the vendee during the delay; and that a mere claim against the vendor was not a valid lien against the property where it was not recorded. Neither was the vendor's failure to furnish a schedule of liens an excuse for delay in building the reduction plant.

Brown *v.* Gordon-Tiger Mining & Reduction Co., (Colo.) 97 Pac. 1042, Nov., '08.

Publications Received.

Any of the books noticed in these columns are for sale by or can be procured from the MINING AND SCIENTIFIC PRESS.

THE CALIFORNIA EARTHQUAKE OF APRIL 18, 1906. Report of the State Earthquake Investigation Commission. Vol. I. Parts I and II with Atlas.

This is the first volume issued by the Commission, which included Andrew C. Lawson, G. K. Gilbert, H. F. Reid, J. C. Branner, A. O. Leuschner, George Davidson, Charles Burkhalter, and W. W. Campbell. Mr. Lawson, professor of geology in the University of California, is chairman, and to his initiative is due largely this important scientific publication. The volume is a quarto of 450 pages, beautifully illustrated, clearly printed, and well arranged. It is full of interesting information, beginning with a general description of the earthquake and its effects. The rupture of the earth's crust has been traced in a line stretching from Point Delgada to San Juan, a distance of 270 miles. The rift follows an old line of seismic disturbance. The plane of rupture is vertical; the vertical displacement was as much as 3 ft. and the horizontal displacement as much as 21 ft., with an average of fully 10 ft. The zone of destructive effects reached for 35 miles on each side of the fault. Nearness to the fault determined the intensity of the shock, but the character of the foundation was a large factor also, alluvial formations and filled ground being much more severely shaken than the solid rock. Several of the Government buildings in San Francisco stood on 'made' ground; owing to settling, before and after the earthquake, the southwest corner of the Post-Office has been lowered 4.72 inches, the Appraiser's Building is 11.23 in. lower on the south side, and the Mint is 5.97 in. lower also on the south side. The maximum effects were observed near Bolinas and Inverness. On the Shafter ranch the fault-crevice entombed a cow, the fault-trace being a trench 6 to 8 ft. wide. Among minor features it is substantially proved that rumbling, as of a train or rushing wind, preceded the big shock. Visible undulations, more than a foot high, were seen on the surface of the ground. Persons were made dizzy and were nauseated. Among the interesting features of the volume is G. K. Gilbert's discussion of faults and fault-movements. For example, he speaks of voids due to faulting. If two fault-walls should not fit accurately, maintaining contact through part only of their extent, there would be voids. If through a part of their extent they are thus separated, then the walls on the average must be farther apart than before the movement. The book is not for general sale. It is priced at $15, and a limited number of copies are obtainable from the Carnegie Institution of Washington. The expense of publication was defrayed by the Carnegie Institution and that explains why the book is disfigured by eccentric spelling. This is the only blemish.

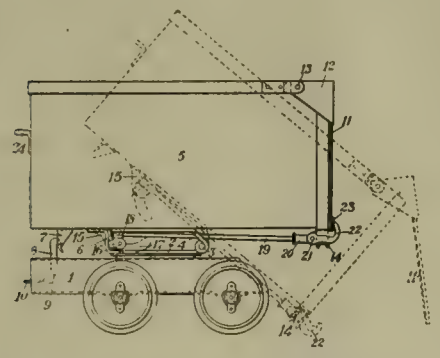
ANNUAL REPORT OF THE DIRECTOR OF THE MINT, FOR THE FISCAL YEAR ENDED JUNE 30, 1908. Pp. 265. Washington. Government Printing Office. 1908.

In addition to the usual statistics of precious-metal production, deposits of bullion, coinage at home and abroad, exports and imports, and multitudinous other details, the report of Director Frank A. Leach calls attention to certain interesting metallurgical improvements. The Government is abandoning the sulphuric acid process for bullion-parting and refining, electrolytic refining plants having already been installed at Philadelphia, Denver, and San Francisco. The losses prove to be less than by the acid process, and the recovery of platinum from the gold bullion is a source of profit, although the quantity contained in any one deposit is so small as to render it impossible to account for that metal to each individual depositor except at a loss. Another metallurgical improvement consists in the process devised by David K. Tuttle, refiner at the Philadelphia Mint, for toughening brittle melts of standard gold bullion by the use of cupric chloride. The chlorine reacts with the troublesome base, which is slagged off, while the copper takes its place in the bullion.

MINING AND METALLURGICAL PATENTS.

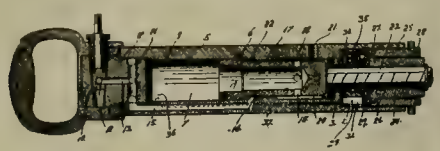
Specially reported for the MINING AND SCIENTIFIC PRESS.

DUMP-CAR.—No. 907,254. Ernst M. Lied, Columbus, Ohio.



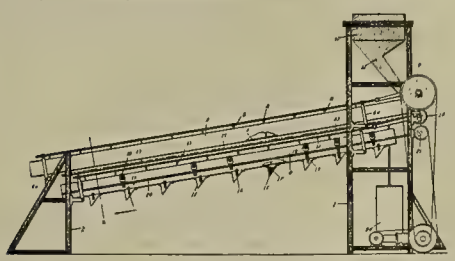
In a dump car pivoted upon a truck and having a swinging door, a cam lever pivoted to said car and adapted to be out of contact with said truck when said car is dumped, a hook for said door, a bar connecting said hook and said lever, said lever being adapted to be brought into contact with said truck when the car is righted, whereby said lever is swung upon its pivot to retract said bar and actuate said hook to lock the door.

MOTIVE-FLUID-OPERATED ROCK-DRILL.—No. 907,041. Charles M. Hampson, Denver, Colorado.



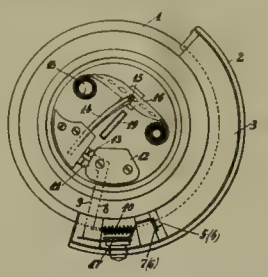
The combination with a casing and a drill, of a motive fluid-controlled hammer piston for striking the latter, a drill chuck provided with a ratchet formed on the face of its inner extremity, a pawl-holder mounted to have an alternating rotary movement for rotating the chuck, pawls carried by the said holder, occupying position parallel with its axis, and mounted to reciprocate in recesses with which the holder is provided, the said pawl-holder having differential surface areas, the casing being provided with means for constantly admitting the motive fluid to the smaller surface area of the said holder, and also with means for intermittently admitting the said fluid to the larger surface area, the intermittent admission of motive fluid being controlled by the reciprocation of the hammer, substantially as described.

GOLD-FILTERING MACHINE.—No. 895,599. Thorstein Thordson, Oakland, California.



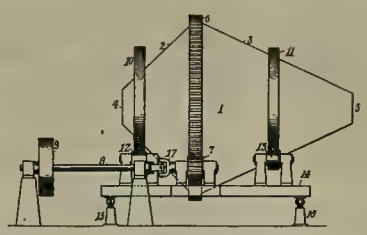
A gold filtering machine comprising stationary inclined troughs disposed one above the other and spaced apart, one of said troughs being of a greater width than the other and having a side sloping inward, and an air blast means disposed intermediate said troughs and directed toward the bottom and said sloping side of the said wider trough, the upper trough having openings directed toward the lower trough, as set forth.

IGNITING DEVICE FOR MINERS' SAFETY-LAMPS.—No. 908,432. Ferdinand A. Wicke, Barmen, and Rudolf Gartenmeister, Elberfeld, Germany.



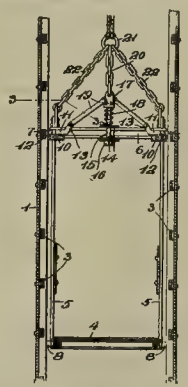
In a miner's safety lamp the combination with the lamp wick of a priming composition, a priming band supporting said composition in proximity to said wick, two spindles supporting said band, a medium heated by an electric current and adapted when heated to ignite said composition, a source of current and connections between the latter and said medium.

APPARATUS FOR DISINTEGRATING ORES AND OTHER MATERIALS.—No. 908,861. Harry W. Hardinge, New York, New York.



In apparatus for disintegrating ores and other materials, in combination, a tumbling barrel comprising a conical inlet portion having an inlet opening, and a conical outlet portion joined at its base to the inlet portion and provided at its apex with an outlet opening; a multiplicity of crushing bodies freely movable inside the barrel; and means for supporting the barrel for rotation about its longitudinal axis and with the lowermost side of the outlet portion making a lesser angle to the horizontal than the corresponding side of the inlet portion.

SAFETY-CATCH FOR MINE-CAGES.—No. 907,835. Henry Martini, Pawnee, Illinois.



The combination with vertically disposed guides and stops arranged thereon, of a cage operating between said guides comprising a pair of I-beams rigidly fixed to one another and arranged at the upper end of the cage, the vertical flanges of which I-beams are extended so as to engage the side faces of the guides, blocks removably fixed to the under sides of the I-beams at the ends thereof, sliding blocks arranged on the fixed blocks, the outer ends of which sliding blocks engage with the stops on the guides, and means connected to the sliding blocks whereby the same are moved outward when the hoisting cable of the cage is broken.

Matte-Tapping Device.

By Edward J. Fowler.

The usual methods for tapping matte in copper or lead smelters necessitates the use of a quantity of pots of various styles and sizes. In lead furnace operations it is usual to crush this matte and after roasting return it to the furnace; or if high in grade, it is shipped to the refinery. In copper-smelting plants, the disposition of matte is made by two systems: first, in case the matte taken from the furnace is to be blown to blister copper, the matte must be taken from the fore-hearth or furnace in ladles and placed in the converter while in the molten condition. In the case of copper smelters making matte for shipment or for re-treatment through other furnaces, matte is generally tapped into small pots, allowed to cool, and then broken up and re-smelted direct; or crushed, roasted, and smelted.

The device shown in this article is particularly useful in case of re-smelting matte. A difficulty in tapping matte from a fore-hearth into pots, is that the stream is generally stopped between the filling of each pot, and as these pots hold only 400 to 500 lb., an ordinary small copper-matte furnace will fill four or five small hand pots at each tapping. This necessitates extra work, such as the actual tapping, sweeping up after tapping, and preparing dollys and tapping bars. Also the wear and tear on the pots themselves is heavy. A good cast-iron pot should last nearly a year, but when we consider the expense of this compared to the weight of matte tapped into it, the life of the pot is comparativly short. In order to have a good matte-handling system using pots, it is advantageous to have cast-iron plates around the fore-hearth, and to have a good sized yard in which the pots can cool. After the pots are cold, it is necessary to spall by manual labor, which operation consumes time and is expensive.



Dumping From Kilker's Matte Tapping Car.

The system here described was first used in Montana, and has lately been introduced into the Selby smelter. The car, popularly called a 'merry-go-round', consists of a steel I-beam frame, mounted on roller-bearing cast-iron wheels. The frame-work has a solid steel upright pin placed between the wheels, which carries the weight of the spider and pans. The spider is made in a solid cast-iron piece, and rests on the upright pin, with hardened steel button-bearings at the bearing-point to minimize the friction. On the spider are placed 16 pans, shaped like the sections cut from a pie. Each pan is held in place on the spider by its own weight only, but is prevented from falling outward by a lug cast on the centre of the bottom of the pan. When these pans are full of matte, they may be easily revolved with a bar. The car is run under the tapping spout, and while the tap is being made the pans are slowly revolved, so that the matte falls in the successive pans one after the other, and the entire mold is filled by a series of layers of matte, so that when they are dumped, the matte is found to be solidified in thin layers, which makes it easy to crush for later operations. The 16 pans hold a total of 3000 lb. of copper matte. After the tap is made, the car is run to the cooling plates, and after standing about 30 minutes the molds are dumped, one after the other. A wrought-iron bar revolves around the centre pin so as to catch these pans for dumping, and the operator has only to put a bar under the back lug and tip it up slightly, when the over-balance will throw the matte from the pan. It is held from going too far by the bar fitting across the back. When three molds are dumped, the operator can throw them back into place by pressing down the top of the pan with a bar. This requires only a few minutes for the entire car. After dumping, the molds are washed with ordinary clay wash, and the car is set in position for another tap. It is possible to tap 3000 lb. every 30 minutes by the use of this car, but it would probably be safer to allow 45 minutes. The cakes are in simple form for handling after they are cooled. With some grades of matte it would be possible to further disintegrate the cakes by pouring a stream of water on them while hot, but this is hardly necessary, as a light tap with a sledge hammer will break the cake, which is only 4 in. thick. The pieces can then be loaded into an ore car. The life of the pans is good, due to the fact that the hot matte does not strike the pans in such a way as to cause excessive expansion and contraction, and the cast iron is not liable to be overheated at one spot, as in the ordinary matte-pot.

Commercial Paragraphs.

The Western Electric Co. recently made a record installation of a telephone switchboard at Franklin, Pennsylvania. The old equipment was destroyed by fire, and within 48 hours an emergency board was in service and within 12 days the complete new switchboard was installed and in working order.

The Dearborn Drug & Chemical Works reports that the general business of the company for the last six months of 1908 was larger than for any other six months in its history, indicating the quick return of prosperous business conditions. The increase during the past six months, and especially for January, in the Eastern department of the company, is particularly gratifying.

Edward C. Brown, manager of the Hawaiian office of the Dearborn Drug & Chemical Works, is making an extensive Oriental trip of three or four months, during which he will visit Japan, the important sea coast cities of China, Australia, the Philippines, Java, and other important islands in the Pacific Ocean.

Chalmers & Williams advise that both the Amparo M. Co., at Etzatlan, Jalisco, and the Cherokee Goldfields, Ltd., at Parral, Chihuahua, have recently purchased Burt rapid cyanide filters.

Catalogues Received.

The Norman W. Henley Pub. Co., New York, has issued a new catalogue of its scientific and practical books for engineers and artisans, which will be sent free to anyone interested.

The Bausch & Lomb Optical Co., Rochester, New York, is distributing a new edition of its catalogue of engineering instruments. This publication is of interest because of the complete specifications given for the optical and mechanical construction of the various transits, levels, and theodolites. The several unique features of the Bausch & Lomb instruments are explained in brief, while an entirely original mining transit is catalogued for the first time. The distinguishing features of this new instrument include a prismatic side telescope. The catalogue is sent gratis upon request.

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EDITORIAL.

FROM the Geological Survey of Canada we have received three maps covering portions of the Province of Nova Scotia. These maps give accurate information concerning the geological structure of an interesting region, but they are more valuable as an example of conscientious surveying by Mr. E. R. Fairbault.

IN 1908 the mines of the Transvaal yielded gold worth £29,957,610 or $145,294,408, as against our preliminary estimate of $144,675,000. The output for December is swollen by about $750,000 taken from the reserves of gold held by various mines. The increase of yield in 1908 as against 1907 was £2,547,400 or $12,355,890. At present 9429 stamps are at work, and the general condition of the local mining industry is better than for three or four years past.

ALTHOUGH care in the preparation of statistics is commendable, timeliness also is of the essence of utility in this branch of arithmetic, therefore we look askance at the pamphlet received this week entitled, 'The Production of Silver, Gold, Lead, and Zinc in the Central States in 1907', issued by the United States Geological Survey. More than a year has elapsed since the activities recorded, and while the analysis of the production of these metals may be interesting to a few, it is sadly belated.

THE INSTITUTION of Mining and Metallurgy, London, has decided to add Corresponding Members to its Council. These are residents in foreign countries and act as 'Committee of Council' for the district in which they reside; in addition, they are empowered "to appoint local consultative committees of ordinary members or associates of the Institution to advise on matters referred to them by the Council or on matters of local interest which the committees may themselves wish to submit for consideration by the Council."

WE NOTE that an estimate has been submitted by the Secretary of the Treasury to the Congress for the construction of a fire-proof building to be occupied by the United States Geological Survey and other bureaus in the Department of the Interior. We hope an appropriation will be voted enabling this suggested improvement to be made without delay, for it is high time something of the sort were done. The recent fire in the building now occupied on F street should be taken as a warning of the danger to maps, reports, illustrations, notes, instruments, library, and other records valued at nearly $5,000,000. Moreover, the building on F street has become so crowded by the growth of the subordinate bureaus annexed to the Survey during recent years that scientific work is

hindered. This crowding, together with the noises admitted from a thoroughfare, renders research and careful study almost impossible. Obviously, a suitable fireproof building with adequate floor-space is required. We hope the Congress will vote the necessary funds.

ENTHUSIASM is always delightful, and this is one of the charming qualities of Mr. Samuel Newhouse. He either believes in a thing or he disbelieves in it; in either case his emotion manifests itself at high tension. Mr. Newhouse believes that the Fink process has come to the copper industry as a metallurgical revolutionary. An insignificant little apparatus is to take crude pyritic ores and turn out blister copper at a single operation of a few hours' duration. We hope it may; we do not know that it will not; but we are sure that the generous patron of Mr. Fink is unprepared to demonstrate as yet that it will. After a single experimental run, before the difficulties and problems that only continuous operation through a long period can bring to light, had enabled the economies of the process to be determined, Mr. Newhouse, jubilant and sanguine, flew to New York, where his own enthusiasm proved contagious enough to enlist capital in a project for erecting large works for the application of the new system of smelting. We wish them well, but we cannot avoid remarking, it's quite too sudden!

MISFORTUNES of varied nature have overtaken the Amalgamated Copper Company during the year just ended. Through fear lest normal production would further depress the price of copper, operations were curtailed in the earlier months of 1908, and devastation by floods in June suspended smelting at Great Falls until September. In view of this the payment in dividends of $12 per share on the 150,000 shares of Boston & Montana stock, and of $1.68 on the 1,200,000 shares of Anaconda stock, derived from profits won, must be declared a creditable achievement. It is estimated that copper has been produced by these companies at a cost lying between 9 and 10½ cents per pound. This is an improvement over former results, but still seems excessive. It is not a little remarkable that the mining methods at Butte have not kept pace with the spirit of betterment which the same companies have displayed in their metallurgical departments. At one end the practice is characterized by the extreme of modernity; at the other it suggests the survival of the ways of a passing generation. Current opinion is that the cost of the ore laid on the surface at the greater mines in Butte is not less than $3.50 per ton. It would seem from this that the chance lay open for shaving the price of Montana copper another cent or two. If publicity in details of mine management were demanded by the stock-buying public, reform in such matters would be hastened.

CURRENT gossip would have us believe that sane business men propose building a cross-country railroad in Nevada to divert the silicious ores of the Goldfield district to Ely for reduction. The names of W. B. Thompson, and F. M. Smith of borax fame, are linked with this enterprise; only one more name would be needed to reveal the actual purpose in view. It would be difficult to contradict the affirmation that Ely is not circumstanced so as to compete with smelters in the Salt Lake valley, except for basic ores. The extra cost of carrying ore past Ely to Salt Lake, against the freight on coal from Utah to Ely, would be sufficient to determine the superior advantages possessed by the Salt Lake smelters, quite apart from metallurgical considerations. The eastern Nevada ores are highly silicious; the contribution of basic material in the concentrates from that region is wholly inadequate as a compensating flux; the Ely ores as they come from the mine are likewise deficient in bases, and are made self-fluxing by concentration. Closer concentration to reduce the silicious content would involve larger losses of copper. The smelting of silicious custom ores at Ely would necessitate the use of barren lime in the furnaces, and that costs money. Until some contributions of valuable basic ores available at Ely may be discovered, we cannot conceive that the smelter at that point would even welcome the influx of Goldfield ores, and the construction of a railroad to convey them there is preposterous. Moreover the reduction of ores by milling at Goldfield can be done at a lower cost than that of freight and treatment at the smelter. But it is plain that with the Nevada Northern as one link in the north, and the unprofitable Tonopah & Tidewater praying for salvation in the south, the construction of 207 miles of track from Ely to Goldfield would afford the Western Pacific an outlet to the Santa Fé tracks at Daggett, from which point it could doubtless make traffic arrangements similar to those enjoyed by the Salt Lake road for entry into Los Angeles. As the approach to southern California for the Gould system, the building of the proposed trans-Nevada line becomes comprehensible.

The Washoe Decision.

Further details from Butte give emphasis to our earlier comments upon the decision of Judge William H. Hunt denying the injunction against the Anaconda Copper Mining Company, and the Washoe Copper Company. The case is analogous to that decided originally in favor of the Mountain Copper Company in California, in which the ruling was based and equity, and the good of the general public was held superior to the advantage of a single individual. The eminent fairness of the Montana decision appears in the fact that, while denying the injunction sought, the petition is held to warrant further hearing to ascertain whether means may not be found to prevent continuing damages from arsenic. It has been demonstrated that small losses of live-stock occur from the settling of this substance over the pastures close to the smelter. Substantial damage from sulphur-fume since the erection of the new stack has not been proved. The plaintiff contended that the flue-gases contained 10.9 milligrams of arsenic per cubic foot, at which rate it was computed that no less than

48,100 pounds of arsenic per diem were emitted from the stack. This would reach the enormous total of over 8000 tons per year. Such a volume of so active a poison would inevitably endanger the lives of the inhabitants of Deerlodge valley, and would render cattle-raising in the zone of the prevailing smoke-drift quite impossible. In winter the condensation would occur immediately and imperil the health of operatives about the works. Arsenic is completely solidified in fume at from 70 to 80° C., or at about 167° F. The smelting company replied that the quantity of arsenic claimed by the plaintiff to issue daily from the stack was in excess of the total quantity present in the ore smelted, the larger portion of which was known to be caught in the arsenic plant attached to the works.

In addition to the fact that the industries of Montana would suffer a staggering blow from the closing of the Washoe smelter, the methods pursued by the farmers in attacking the copper company savored so strongly of what can only be defined as blackmail that the test case brought by Fred J. Bliss was seriously weakened. Combinations for protection violate the rules of society when they impose conditions of settlement with the alternative of a threatened suit at law. When it transpired that the plaintiff was so tied to the Farmers' Association as to be unable to compromise with the smelting company, the case smacked of conspiracy with unfair ends in view. When finally it was proved that the plaintiff could at any time rent the land to dairymen, the plea for relief necessarily fell to the ground. The Court held that under the circumstances the plaintiff should be content with the remedy open through trial by jury to recover for past damages. A hearing will be given on February 15 to ascertain what reduction of the smoke-trouble can be effected. The plaintiff claimed that the temperature in the stack 50 feet above the base was 189° C. If this were true, it would be plain that the gases would carry arsenic and sulphuric anhydride in large amount. As sulphuric anhydride begins to precipitate at about 150° C., and as deleterious quantities of arsenic cannot remain in the fume at 100° C., there would seem to be opportunity for the smelter effectually to put an end to this vexing and costly controversy.

Colombia.

In round numbers, Colombia has yielded $700,000,000 to the world's stock of gold. As Mr. F. Lynwood Garrison points out elsewhere in this issue, that quantity of metal has been obtained almost entirely by crude washing of alluvial deposits with the batea and by 'booming' or ground-sluicing. Modern appliances have not been employed; hence this gold has come only from gravels of extraordinary richness. That fact alone is significant of the possibilities for operations on a large scale by modern methods. Mr. Garrison appears to be justified in concluding that when the resources of Colombia are properly developed the returns will be such as to make that Republic the greatest gold producer in the world. The gold district lies principally in the western portion of the country, in the valleys of the Cauca and the Atrato. The most extensive placers are in the Cauca valley, beginning at Quilichao, in the Department of Popayán. From that point the gold-bearing gravels are continuous for a distance of 400 miles toward the north. Nowhere in the world exists a goldfield of equal extent. Moreover, the tributaries of the Cauca, fed by the rains and snows of the high Sierra, offer unlimited opportunities for the development of electrical power in every part of the gold-bearing territory. Of nearly equal extent are the goldfields of the Department of Quibdó, occupying the northwestern corner of the Republic, from Cali to the Caribbean Sea, within which is included the famous Chocó with its placers of gold and platinum. Aside from these riches in the royal metal, Colombia possesses one of the largest coal districts in all the Americas. Coal is found from the Ecuadorian frontier to the Caribbean, and from the plains of Bogotá to the Pacific. At Pacho, near Bogotá, is a modern iron furnace and rolling mill, the Fundición de Hierro la Pradera, smelting the ore mined within sight of the works with coke made from coal beds close-by. In the territory bordering the Caribbean, chiefly in the Department of Santa Marta, are evidences of large deposits of iron, coal, and petroleum, as yet undeveloped. Copper is reported throughout the great central Andean chain as far south as the Territory of Caquetá, and it must be borne in mind that both fuel and water-power are ever present to facilitate the development of these deposits. The great immediate need is improvement in transportation facilities. In the days when Mr. Blaine's infectious confidence in the immediate response of South America to the engines of progress set so many adventurers concession-hunting at the Spanish-American capitals, a few commendable enterprises were started in Colombia. Mr. S. B. McConnico undertook to develop the possibilities of the magnificent port of Cartagena by a railroad which had an empire of opportunity before it; the railroad reached the Magdalena river, and left the opportunities to one side. Mr. W. B. Cherry died before his line from Buenaventura reached Cali. A few interior lines, furnishing outlets to the Magdalena river for Bogotá and Medellín, together with the little Sabanilla-Barranquilla road, constitute the whole of the railway development in the Republic, and it must be said that the country has paid dearly for the few miles of track which her subsidies have called into existence. But from the signs of vigor and sanity in the present Administration, wiser governmental policies will hereafter prevail. What has been done in Mexico will be repeated in Colombia. The period of government by revolution seems ended there under the wise guidance of President Reyes, and the lure of gold and the opportunities for the basal industries of civilization must soon bring this neglected country to the front. It is a country friendly to American enterprise, in spite of the occasion for resentment offered by the flagrant violation of the territorial integrity of the Republic by our Department of State joining with revolutionaries for the secession of Panama.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

S. W. Mudd is in New York.

W. A. Farish is at Los Angeles.

Albert Burch is at Kellogg, Idaho.

H. W. Turner is in southern Nevada.

E. P. Mathewson was recently at Cananea.

Edgar Rickard was at New York this week.

Scott Turner is now at Kennett, California.

H. L. Twite has returned to London from Bolivia.

Henry Brelich has returned to London from Manchuria.

Henry W. Lake has returned from Manchuria to England.

H. Vincent Wallace, of Nogales, Arizona, is at New York.

Henry Taylor, of John Taylor & Sons, is in Tasmania at present.

Theo. F. Van Wagenen is at New York, on his way to Europe.

L. C. Graton is about to resign from the U. S. Geological Survey.

Henry Krumb was recently at the Ray mine, near Kelvin, Arizona.

J. Malcolm Maclaren is on his way to Kalgoorlie, Western Australia.

H. S. Wierum has been appointed consulting engineer to the Lewisohns.

J. E. McAllister, manager of the British Columbia Copper Co., is at New York.

G. E. Alexander, of Denver, spent the greater part of the winter traveling in Mexico.

C. W. Botsford, of Guanajuato, has been examining mines near Alamos, in Sonora, Mexico.

W. L. Cummings, of the Bethlehem Steel Co., was recently at Alamos, Sonora, Mexico.

Pearce & Parker have opened an office for assaying and engineering at Alamos, Sonora, Mexico.

Wilbur A. Hendryx, of Denver, has left New York and gone to Arizona on professional business.

T. Lane Carter is in Nicaragua, examining mines. His address is, Care of American Consul, Bluefields.

John E. Rothwell has been ill for several weeks past, and is now recovering from a serious operation.

J. W. Fetherstonhaugh, lately superintendent for the Goldfields of Mysore Co., has returned to London.

George A. Schroter was recently at the mine of the Creston-Colorada Co., at La Colorada, Sonora, Mexico.

F. S. Nicholls is no longer connected with the Famatina Development Co., although he reported on the smelting plant.

E. McCormick, of Calumet, Mich., recently passed through Chicago, on his way to examine property in Washington and Oregon.

Walter G. Perkins has accepted an appointment as metallurgist to the Tanganyika Concessions, Ltd., and will shortly proceed to Africa.

André P. Griffiths and E. A. Mannheim have entered into partnership as mining engineers and mine managers, at 781 Salisbury House, London.

Henry M. Adkinson, manager for the Gold Pioneer Co., at Telluride, Colo., has returned to Denver from a business trip to Chicago, Boston, and New York.

Cortlandt E. Palmer has changed the style of his professional card, but this does not mean any change in his relations with the three companies by whom he is retained as consulting engineer.

Latest Market Reports.

LOCAL METAL PRICES—February 4.

Antimony	12@16c	Quicksilver (flask)	$44½@45½
Casting Copper (scrap)	8½@13½c	Spelter	6¼@7c
Pig Lead	4.45@4.50c	Tin	32@33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 28. £. s. d.		Feb. 4. £. s. d.
Camp Bird	0 16 0		0 16 0
El Oro	1 2 6		1 2 6
Esperanza	3 1 0	ex div.	3 0 0
Dolores	1 10 0		1 10 0
Oroville Dredging	0 9 9	ex div.	0 8 9
Mexico Mines	4 17 6		5 0 0
Tomboy	0 18 9		0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Jan. 29	13.37	4.13	5 08	——
" 30	13.37	4 13	5.08	51⅞
" 31	Sunday.	No market.		
Feb. 1	13.37	4 13	5.08	52⅛
" 2	13.25	4.12	5.06	51⅞
" 3	13.25	4.12	5.06	52⅛
" 4	13.31	4.12	5.06	52

SOUTHERN NEVADA STOCKS.

San Francisco, February 4.

Atlanta	$ 14	Laguna	——
Belmont	84	MacNamara	30
Booth	22	Manhattan Con	4
Columbia Mtn	14	Midway	20
Combination Fraction	1.17	Montana Tonopah	72
Daisy	72	Nevada Hills	1.50
Fairview Eagle	30	Rawhide Queen	42
Florence	4.00	Sandstorm	14
Gold Bar (Bullfrog)	1	Silver Pick	10
Goldfield Con	8.12	St. Ives	16
Gold Kewenas	22	Tonopah Extension	49
Great Bend	25	Tonopah of Nevada	6.00
Jim Butler	15	Tramp Con	11
Jumbo Extension	18	West End	31

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Jan. 28.	Feb. 4.
Amalgamated Copper	75⅝	75¼
American Smelting & Refining Co	84	84¾
Boston Copper	14	13
Butte Coalition	23½	24
Cumberland Ely	8⅝	8⅛
Dolores	7	7
El Rayo	3¾	3⅝
Giroux	8¼	8¾
Greene-Cananea	10⅞	10½
Indiana Sonora	4¾	4¾
La Rose	6½	6½
Miami Copper	13	13¼
Nevada Consolidated	18⅛	18¼
Newhouse	5⅝	5⅛
Nipissing	9⅞	9⅞
Ohio Copper	6⅝	6½
Tennessee Copper	44⅝	40
Utah Copper	44	43½
Yukon	4⅛	4⅛

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. February 4.		Closing prices. February 4.
Adventure	8	Mohawk	62
Ahmeek	140	Nevada Con	18⅛
Allouez	38½	North Butte	74¼
Amalgamated	75	Old Dominion	51½
Arcadian	2½	Osceola	130
Atlantic	14	Parrot	27¼
Boston Con	13¾	Quincy	89
Butte Coalition	24¼	Rhode Island	5
Calumet & Arizona	105	Santa Fe	2¼
Calumet & Hecla	645	Shannon	16¼
Centennial	31	Superior & Pittsburg	15⅝
Copper Range	——	Tamarack	75
Daly-West	9½	Trinity	15
Franklin	15	United Copper Con	13¾
Granby	100½	Utah Copper	43⅞
Greene-Cananea, ctf	10½	Victoria	4⅝
Isle Royale	——	Winona	5½
Mass	5	Wolverine	144⅞

(By courtesy of E. F. Hutton & Co., 490 California St.)

General Mining News.

ARIZONA.

GILA COUNTY.

Work was resumed on Friday, January 29, at all the mines in the Globe district which closed down five days before. There was no interruption in smelting during the month, so the 'late unpleasantness' between the operators and the miners' union has fortunately not been a very serious affair.——The Arizona Commercial Copper Co. is carrying on development at the Eureka shaft and at the Black Hawk workings. At the latter a raise is in progress to connect the 550 and 500-ft. levels. When this is completed, a hoist will be installed to sink a winze from the 550-ft. level in the west drift, where an orebody 38 ft. wide has been cross-cut. The station at 710 ft. in the Eureka shaft will soon be finished, and as soon as a larger station pump arrives a drift will be started at that level, which is expected to run into another orebody. Grading for the smelter is well under way.

PIMA COUNTY.

A pleasing report has been addressed to the shareholders of the Twin Buttes Mining & Smelting Co. by the directors.



Map of Arizona.

They have cleared off an indebtedness of $75,000, and left a good cash balance; the superintendent, McDermott, has discovered several excellent orebodies; and the usual weekly shipments of 8 carloads have brought good returns from the smelter at El Paso. The company now has about 60 men at work in the mine.——The Grand Central mines, near Tucson, consist of 10 mining claims, on which the vein outcrops prominently for a length of about 1500 ft. In the vein are three shafts with several drifts and cross-cuts, which have exposed not only gold and silver ore, but a valuable deposit of vanadinite, the vanadate and chloride of lead. George H. Daily is manager.

PINAL COUNTY.

Sherwood Aldrich, the president of the Ray Consolidated Mining Co., states that the company expects to break ground by the first of July for the new mill at Ray, the capacity of which will not be less than 2000 tons per day, and possibly as large as 6000 tons; that the company now has 10 to 12 million tons of ore in sight, running about 2½% copper, which can be mined very cheaply by the caving system; and that the building of a smelter is a certainty later on, but not immediately.

E. Feltman and H. Quinn have brought back from their claims near Helena some fine specimens of cinnabar, which they found at a depth of 14 ft. This is believed to be the first discovery of quicksilver ore in the region. The claims are situated on Hot creek, and are eight miles due north of Helena.——A. G. Cadogan and S. Rothschild, superintendent and general manager, respectively, have tendered their resignations to the directors of the Homestake-King Mining Co., of Bullfrog, to take effect February 10, when S. B. Tyler will assume entire charge.——The total output of the Tonopah mines for the past week was 4608 tons, of an estimated value (the shipping ore being valued at $60 per ton and the milling ore at $25 per ton) of $115,200. The Tonopah Co. sent 2500 tons, the Belmont 600 tons, the Montana-Tonopah 708, the Midway 100, the MacNamara 300, West End 100, and Jim Butler 300 tons to the mills, making the total shipments for the week to the mills 4608 tons.

YAVAPAI COUNTY.

The Santa Maria Gold Mining Co. has been taken over by some mining men of Utah and Montana. George B. Weaver and J. F. Cowan have been examining the property, on which 1400 ft. of development work has been done, and recommended the purchase of the property to their clients. Among others interested are H. C. Weaver, of Salt Lake, and M. S. Browning, of Ogden.

CALIFORNIA.

INYO COUNTY.

The mining men of the northern district of Inyo county are well pleased with the completion of the Southern Pacific cut-off, by which it is rendered possible to ship ores to tidewater at San Pedro; the distance is from 200 to 300 miles, and cheap water transport can usually be got thence to the northern smelting regions. These conditions have added vigor to the mining developments of the county.——A company of Los Angeles capitalists is making a number of exhaustive tests of the graphite and iron deposits in Mazuka canyon. The company intends, if these minerals meet requirements, to erect a plant to use the graphite and hematite as a base for a mineral paint.——George H. Farish, of Denver, is making a thorough examination of the Cady & Reed copper property in Eureka valley.

NEVADA COUNTY.

The Gold Flat, Pittsburg, Potosi, and the extensions of the Gold Flat and Pittsburg mines have been consolidated into one big company, named the Pittsburg Gold Flat Mines Co. The consolidation means the opening up of the properties on an extensive scale. Joseph Weissbein and Mark B. Kerr have arrived to take preliminary steps looking to a resumption of work at the properties. The officers of this new company are: Joseph Weissbein, president; Mark B. Kerr, vice-president and manager; Frank Sperling, secretary; S. L. Ackerman, Samuel Granger, and W. H. Martin, directors.

SHASTA COUNTY.

The Rough and Ready mine, owned by Edward Bracket and situated in the Lower Springs district, has been sold to the Shasta Mining Co. for $20,000. The final payment was made during the past week. This mine was one of the steadiest ore shippers to the Keswick smelter during the operation of that plant.——The equipment has arrived at the Gladstone mine, near French gulch, for an electric line to transport ore from the mine to the 20-stamp mill.

SISKIYOU COUNTY.

Forty-two mining locations have been made since the new year on Klamath river, between Happy Camp and the Humboldt county line. The total area is 3600 acres, which was staked out by nine men, presumably for dredging purposes. These are the same men who last year located numerous mining claims on Klamath river, above Happy Camp.——The big dredge at Callahan started up on January 4, after repairing their bucket line. It is the intention of the company to put in a complete new bucket system this summer.

——Elliott & Co., operating the Finley hydraulic mines at Sawyers bar, have their pipes and giant laid and are now piping off surface dirt with two crews. They hope to be able to get to their pay-gravel by the opening of the spring months.——Charles Johnson, the Six Mile creek placer miner, is handling a large body of gravel with his self-shooter and has washed out some good sized nuggets.

COLORADO.

CHAFFEE COUNTY.

Leadville parties are negotiating to take up the Bradbury discovery, made last summer near Granite. Bradbury has made several shipments of gold ore, and is desirous of interesting local capital.

LAKE COUNTY.

The stored-up waters of the Resurrection mine on Little Ellen hill are now pouring into California gulch through the Yak tunnel. When the breast of the drift from the Yak reached a point approximately 35 ft. from the old workings a diamond-drill hole was started to tap the water. In order to guard against all possible contingencies J. R. Champion, the superintendent, placed a valve in position to control the flow, and a pressure of 250 lb. to the square inch was registered. It is believed that this will lower the water in the Resurrection at the rate of a foot per day, and effect complete drainage before May 1.

OURAY COUNTY.

The last annual report of the U. S. Geological Survey gives the total output of the mines of the county in 1907 as nearly three million dollars. The Sneffels district produced over 97% of the gold, nearly four-fifths of the silver, approximately three-quarters of the lead, and over 91% of the total values of the metal output of the county; and the Camp Bird mine produced nearly $600,000 more in value than any other mine in Colorado during the year.

SUMMIT COUNTY.

The adit of the Pitt Ores Co. has broken into a new orebody below the old workings. The mill recently erected at the mouth of the adit is completed and is now ready to handle all the ore that is produced.

TELLER COUNTY.

At the annual meeting of the shareholders of the Cripple Creek Drainage & Tunnel Co. all the directors were re-elected except S. S. Bernard, who is succeeded by A. L. Burris to the presidency. The treasurer showed that of the total of $388,500 subscribed toward the tunnel, $175,000 is still due. The company has $23,819 cash on hand and has paid for all work up to January 1, 1909, so that it has nearly $200,000 with which to carry on the work. It is estimated that about $120,000 additional will be required to complete the tunnel. Of the total of 15,500 ft. to be driven, 4872 ft. had been completed in the three headings to January 1 and 246 ft. bored this month, making a total of 5118 ft. to date.——The New Pearl Gold Mining Co. has just incorporated under the laws of Arizona, and intends to work the Log Cabin vein on Mineral hill; it also has bonds on the Laura Lee and New Pearl claims, the owners of which are F. J. Campbell, J. F. Wood, and F. L. Sigel, of Denver. ——Four carloads of machinery have arrived for the Wishbone mill. J. H. Whalen, representing the firm of Chisholm & Matthews, of Colorado Springs, has come to the district to superintend the erection of the Edwards roaster, and stone masons are already at work on the foundations. The new roaster will have a daily capacity of 100 tons and will be used for the refractory ores.——Sinking is in progress in the main shaft of the Strong Gold Mining Co., at Victor, and will be continued to the 1100-ft. level, or until water prevents further sinking. This level will correspond with the 1500-ft. level of the Portland No. 2 shaft, the deepest of the Battle Mountain district. It is believed that the ore-shoot under development on the main Strong vein, at the 1000-ft. level has proved the richest orebody disclosed to date. The mine is shipping an average of 4 cars per day to the Golden Cycle mill at Colorado City. The total production of the Strong mine is not published, but it is a matter of record that the company had paid out in dividends $2,475,000 to the close of 1903. At a conservative estimate the company will have distributed not less than $3,500,000 in dividends to date.

IDAHO.

SHOSHONE COUNTY.

(Special Correspondence).—The ore in the Alice mine, on which a strike was made last summer, continues to hold out well and to improve. Recent assays give 40% lead and 30 oz. silver per ton. The principal owners are Richard Wilson and Walter McKay, of Portland, James F. McCarthy, of the Hecla mine at Burke, and Fred N. Russell, of Seattle. They will start work for a new concentrator within two months if the ground be free from snow.——A cave-in of part of the upper workings took place in the Tiger mine, owned by the Federal Mining & Smelting Co. at Burke, but no material damage was done. The accident took place about 100 ft. from the Tiger mill. The mine had just been abandoned by the Federal company and the greater part of its machinery installed in the Standard mine at Mace. The shipment of ore is still being continued by lessees.——Before the close of the summer upward of $100,000 will have been spent on the H. E. M. property in Revenue Gulch district. The recent strike made on the property has turned out admirably, and it is the intention of the company to erect a concentrator and begin mining and shipping. In the meantime a contract for 400 ft. of work has been let to C. D. Roberts, of the C. & R. property at Burke, the terms of which demand that not less than three shifts be employed. At the same time the force of men in the upper workings has been materially increased.——At a recent meeting of the directors of the Ajax Mining Co. it was decided to double the force of men at work on the property, and arrangements have been made accordingly. This action is taken in view of the splendid showing in the drift which has now been run about 1600 ft.——A report of the affairs of the Copper Plate Mining Co. has been issued. The finances of the company are in fair shape considering the fact that the mine has been under steady development for months past, having done about 2200 ft. During the year $6300 was spent in development, while a balance of about $500 still remains on hand. The annual meeting of stockholders has been called, and steps will be taken to raise funds for the continuation of the work.——All arrangements have been completed by which the Success mine, operated by H. F. Samuels, of this city, will resume operation on April 1. A considerable amount of ore is blocked out ready for treatment so that both mine and mill will resume operations at the same time.——The strike made in the Black Horse mine in the Murray district some time ago has now widened out to about 7 ft., practically all of which is clean shipping ore. The ore was encountered in a drift at a depth of about 1000 ft.——A good record has been made by the contractors in the development of the Hector Mining Co. on Canyon creek. During the past 30 days 140 ft. of progress has been made, of which 92 ft. was in hard rock, not a single timber having been required in the mine. Ore is showing in small quantities, but nothing of commercial value has yet been found.

Wallace, January 30.

NEVADA.

ESMERALDA COUNTY.

The National Ore Purchasing & Reduction Co. has started the grading and foundation work for its custom mill in the town of Rawhide. The machinery has been shipped, and includes rolls, Graupner centrifugal quartz-mills (which will reduce the ore to 80-mesh), and a Bertram Hunt slime filter. This last is a continuous type of filter designed to separate the gold-bearing cyanide solution from the pulp, and will be the first one of its kind ever installed. J. W. Heismer is president of the company, and L. M. King is manager.——The second annual report of the Goldfield Consolidated Mines Co. for the year ending October 31 shows that the company had $911,000 in the treasury, after expending

approximately $900,000 on mill, railroad, and pipe-line construction. The water supply stored on Columbia mountain is equal to running the mill for 10 days in the event of a break in the Lida pipe-line. Actual saving on the plates, it is claimed, has been 94 to 97%. Cost of mining, milling, and transportation has been reduced from $11.27 per ton to $8.81, with a prospect of a further reduction. Concentrates that cost $30 to $50 per ton to ship and smelt are now treated at home for $5 per ton. The total production for the year shows 32,755 tons of $41.50 per ton; and 12,254 tons of second-class ore have been placed on the dump, worth $7.76 per ton. The gross value of ore produced was $2,400,-191, and it is hoped that the operation of the new Combination mill will effect a saving of $2,000,000 per year.

What may become an important turquoise mine has been discovered in the vicinity of Crow Springs, by John Kennedy, who was formerly a plumber's assistant in Tonopah. The find was made at a point nine miles southwest of Blair Junction, and occurs in black limestone veins, the widest of which is about ten inches at the surface. Several small shipments have been made to Tiffany of New York.——The statement issued today by the secretary of the Florence-Goldfield Mining Co. shows that the company has expended during the year 1908 the sum of $344,240, in addition to paying out $420,000 in dividends. The total earnings for the year were $515,708, and the balance on hand at the beginning of the year was $131,769. This statement is disappointing when compared with that for the first six months of 1908, which showed a cash balance of $690,000, when the new mill was understood to have been fully paid for.

EUREKA COUNTY.

The mining camp at Windfall is four miles south of Eureka; it was worked many years ago, producing much silver and lead. A low-grade silver-lead ore is now being shipped to the Utah smelters at the rate of 300 tons per day. For, while the value is less than $10 per ton, yet a reasonable profit can still be made. A new ore deposit has recently been discovered in a different formation, which carries gold; and it has been found to be perfectly amenable to the cyanide process.

LANDER COUNTY.

Placer operations on an extensive scale will begin within a few days at Ione, 115 miles north of Goldfield. The managers are putting in some two miles of pipe-line, and a Fairbanks-Morse pump. They claim that their gravel is worth over $1 per cubic yard, and that there is an abundance of it. The controlling interests are Thomas D. Murphy, E. R. Collins, and D. D. Muir, all of Goldfield.

LINCOLN COUNTY.

William A. Farish has examined the properties of the Nevada-Utah Mines Co., at Pioche, for the president, George E. Learned, who states that the developments have been very satisfactory. The ore faces at the 900-ft. level are all showing a higher grade of ore than on the 800. They have run into a copper vein that gives 4% copper and 20 oz. silver, while in the silver-lead orebody they have struck a shoot yielding 100 oz. silver and 50% lead. Though the output is now limited to a production of 50 tons per day, the underground workings are in good shape to produce 200 tons in that period.

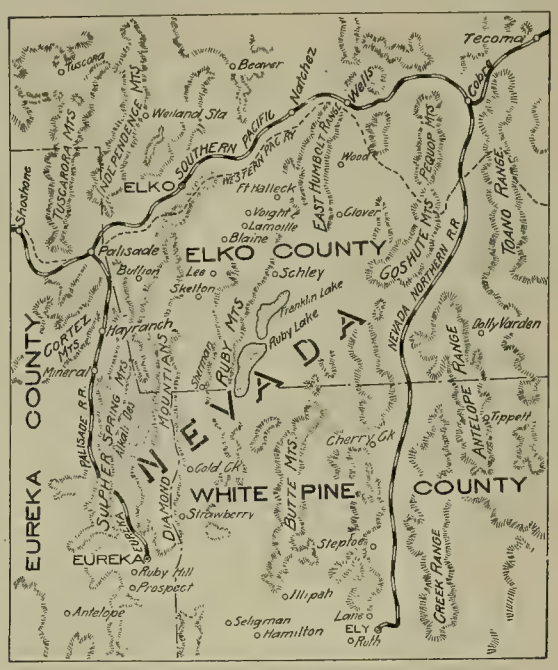
NYE COUNTY.

The Melvin and the Monster claims, at Round Mountain, have both been producing tungsten ore, and Dr. Gohlin is endeavoring to consolidate the claims and make arrangements for milling the combined output. Some tests have already been made by Henry E. Wood & Co. of Denver, and the concentrate produced was purchased at the rate of $10.20 per unit.——News comes from Tonopah that during the past week the Jim Butler property shipped to the Belmont mill at Millers, 300 tons of milling ore. The orebodies on the first level average about three feet in width, and the stopes on the second level are showing five feet of good quality ore. On the intermediate level the vein is still producing the high-grade ore.——The directors of the Round Mountain Mining Co. have decided to increase the capacity of the mill to 110 tons per day. A compressor with 10 drills will be added; also one tube-mill. The present production is $30,000 per month. The average cost of treatment is $5.40, but the improvements will doubtless reduce this. All the levels are in ore from 3 to 14 ft. wide, and the backs are estimated at $1,000,000. On March 18 the fourth quarterly dividend will be declared, absorbing $32,000.

John R. Nolan, George R. Fanshaw, Alonzo Oxsley, and C. W. Merryfield, of Spokane, have taken over seven claims in the Clifford district, 50 miles northeast of Tonopah. The first two are on the ground doing assessment work. The Clifford mine in the same district was located by Edward and James Clifford, of Spokane, who took out $30,000 two years ago, selling the property afterward to the Broken Hills Mining Co. for $350,000. Merryfield says that a railroad has made a survey through their property and that the line may be built in 1910.

STOREY COUNTY.

A fire in the Sutro tunnel destroyed about 700 ft. of the timbering between the Combination and Consolidated Virginia shafts on the night of January 27. T. F. McCormick, superintendent of the Ophir, and Bernard O'Hara, superintendent of the Sutro Tunnel, state that the fire raged in the north lateral, and that the tunnel was burned to the Combination connecting drift. The shafts were not damaged. In some places the tunnel caved, and for a time it was feared that the water would back up to the Ward and Consolidated Virginia shafts. Bulkheads were placed in the north lateral and the fire was quickly got under control. Estimates of damage are not yet certain, but so far as is known the damage has been comparatively small. The stocks of the companies involved dropped from 10 to 50%, but recovered most of this loss during the next day.



Map of Eastern Nevada.

OREGON.

BAKER COUNTY.

Thirty-three miles of the railroad from Huntington to the Iron Dyke mine are completed, and trains are running down Snake river to the mouth of Powder river. At the Ox Bow bend, about five miles above the Iron Dyke, 400 men are employed in the construction of an electric-power plant with a capacity of 25,000 hp. Both the power company and the railroad company are putting on all the men they can get, and 2000 men are employed on bridge work, driving tunnels, and grading for the ties and rails. The

Iron Dyke mine is at Homestead, which will be the terminus of the railroad. Large quantities of copper ore are said to be awaiting shipment on the completion of the road.——Samuel Newhouse, of Salt Lake, recently took over the controlling interest in the Rainbow mine here. This is a free-milling gold property in Mormon basin.

UTAH.

JUAB COUNTY.

A cave occurring on the 230-ft. level of the East Tintic mine has displayed to the manager, Ralph Kellogg, some good grade silver-lead ore, which is believed to be a continuation of the vein developed by the 130-ft. level.——Sinking is still in progress at the Bullock mine, near Silver City; it is the intention of the management to drive under the ore exposed in the old workings on the 200-ft. level.

TOOELE COUNTY.

Work has begun at Tooele City to do the grading for the new road of the International Smelting Co. to Pine canyon, where a smelter is to be built. By building a spur from the Salt Lake route at Tooele City the company has but 6½ miles of work to do. Steam will be used upon the road for the first two years, after which it will be equipped with electric cars. The plans are not yet completed, but it is the company's intention to install the smelter with a capacity of 2000 tons.

WASHINGTON COUNTY.

The Virgin River Oil & Development Co. has not as yet had much success in the search for oil in payable quantities. But there are now good indications of a 40-ft. petroleum zone at a depth of about 1200 ft. Unfortunately several of the rigs have dropped their boring tools and are engaged in a 'fishing job.' Among others operating are the G. I. Hastings Co., the Virgin Valley Oil Co., managed by S. A. Halterman, the Grafton Oil Co., and H. H. Clark.

WASHINGTON

STEVENS COUNTY.

(Special Correspondence).—In the Metaline lead district, mining is dull, as the mines are confronted by several difficult problems. It was thought at one time that the ore of this district could be more profitably handled in a concentrated form, and the Spokane Lead Mines Co. erected a concentrator to treat the product of its mine, but owing to the character of the ore and to financial trouble, this mill was only run a short time. Early in 1908 the stockholders of the Morning and Mammoth mines formed a company, known as the Morning-Mammoth Concentrating Co., and this concern took a contract to mill the ore from the two mines named, but for various reasons this concentrator has never been set up, although some of the machinery is on the ground. One of the valuable constituents of Metaline ore—the lime gangue—is lost in the process of concentration, so that this ore is of more value to the smelters in its original state than after concentration. It is thought that a solution of these problems is offered in the starting up of the Panhandle smelter, on Lake Pend d'Oreille and the building of the Washington & Idaho railway into the Metaline district. Metaline ore is desirable for this smelter, and with a reasonable smelting and freight rate it is believed that this low-grade ore can be shipped at a fair margin of profit. The average low-grade ore of this district carries about 10% lead, while in the shipping ore of better grade 4 to 8 oz. silver and some gold are found, as well as a higher percentage of lead.——The Keller & Indiana Smelting Co. has acquired some additional property to that held by the company heretofore, and is accumulating ore and fuel at the smelter preparatory to blowing in this plant.——A new company, capitalized at $1,500,000, has taken over the Republic mine, at Republic, from the county, which acquired it through delinquent taxes. A force of 30 men is being worked, and a small compressor and some electrical machinery have been ordered and should be at the mine early in February. A car of ore recently shipped returned the company $74 per ton. The ore is being treated by the Granby smelter. The new owners of the Republic seem sanguine in their intentions to make the Republic a paying mine, but they will no doubt have to contend with many of the difficulties that the old company encountered in handling the refractory ore of this mine.——Mining men who are heavily interested in the Granby Consolidated are now developing the Holden mine, in the rich Chelan Lake district of central Washington. The Holden is a huge low-grade deposit, and will make another mine similar to the Phoenix, B. C., mines now being worked by the Granby Co. Railway facilities are lacking in the Chelan district just now, but it is understood that plans are under way for the building of a road into that district as soon as development of the mines has progressed far enough to warrant the necessary expenditure. The Chelan Butte Gold Mining Co. owns three valuable claims in this district, and is now taking ore that carries $150 per ton in gold from the 200-ft. level. The company has 150 sacks of high-grade ore ready for shipment which will average $6 to $7 per sack of 70 lb.——Coal mining is the principal branch of the mining industry of this State today, and the Roslyn district is the most extensively worked field. Five new and independent companies have opened up mines in Roslyn district during the last eight or nine months, all of which are increasing their capacity as rapidly as possible. The coal of this field is a superior domestic product and is in great demand. Nearly 66% of the coal production of Washington is consumed by the railway and steamship companies. The Northern Pacific Railway Co. owns many valuable coal mines and produces about 44% of the entire output. The coal output for 1907 was 3,713,824 tons, valued at $7,427,648; about $2 per ton. The coke produced amounted to 61,400 tons, value $276,300, or about $4.50 per ton. The figures for 1908 have not yet been completely compiled, but are expected to exceed those for 1907 by a good amount. North of the Roslyn coalfields there are large areas of valuable iron deposits that will one day be an important factor in the manufacturing industry of the State of Washington. The possibilities of these vast fields of coal and iron, lying so near to each other, are manifold, and hold forth much of promise for the mining industry of the State of Washington, which is as yet only in the first stages of development.

Spokane, January 28.

The Delmonico mine, three miles east of Chewelah, which was recently taken over by the New Dominion M. Co. at a total cost of $25,000, has received the first consignment of machinery from Spokane. This is a duplex plunger pump, capable of handling 85 gal. per minute. The shaft is now 120 ft. deep, and will be sunk 300 ft. farther. The company has ample finances.

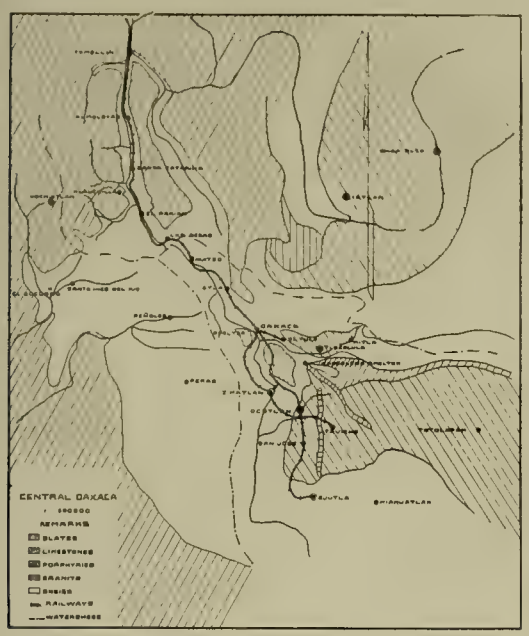
CANADA.

BRITISH COLUMBIA.

A company is being formed with a large capitalization to take over the 27,000 acres of coal lands on Graham island, acquired from a Victoria syndicate by the firms of Tracksell & Butler, and Gray, Hamilton, Donald & Johnson, of Victoria. An application is now before the legislature for a charter for a railway between Skidegate and Rennel sound to open up the mining district. The Victoria company, which has held the coal property since 1885, includes William Wilson, C. H. Todd, Capt. John Irving, Robert Tennant, Major Nichols, T. T. Gore, Dr. G. L. Milne, W. A. Anderson, and others.

The British Columbia Copper Co. took advantage of the forced close-down last week, through lack of power, to make some necessary repairs to the smelter plant, thus obviating a close-down later on. Only two of three furnaces have been in commission during the past week, but it is expected the full battery will again be operating in a few days.——The Canadian Pacific railroad has struck gas at a depth of 1900 ft. at Bow island in the Medicine Hat gas field. The flow is estimated at 1,500,000 cu. ft. per day.——The cable for the tram line which the owners of the Golden Eagle mine are building from the property on Volcanic Mtn. to the Kettle Valley railway, has been received at the mine, and it is expected that the tram will be in operation

in about six weeks.——It is reported from Winnipeg that a strike of the British Columbia and Alberta coal miners may take place after March 31, on which date the two years' agreement between miners and owners comes to an end. The men demand a rate of increase which the operators do not consider reasonable to allow. About 2,000,000 tons are produced annually by the Province of British Columbia alone.——Mineralogists have been puzzled by the appearance of ore from the Republic mine, which more resembles house-plaster than anything else; it carries free gold, but so fine as to be invisible to the naked eye. The mineral petzite has also been found, and some carload lots have netted $65 per ton from the Grand Forks smelter. An abundant tonnage has been broken, and a good profit assured, as freight and treatment rate only amount to $6.50 per ton.——The first payment on the Knob Hill mine was made on December 29. The purchasers are capitalists from Philadelphia, Pennsylvania, represented locally by S. L.



Map of Central Oaxaca.

Boyer. They have completed about 1000 ft. of development since taking the option last spring; installed a compressor and made a great many other improvements. Boyer will assume personal charge upon his return from the East.——According to J. L. Warner, manager of the Kootenay Belle mine, in the Nelson district, that mine will immediately increase its capacity by 10 additional stamps. The present production with four stamps is $5000 per month.

MEXICO.

W. R. Ramsdell, president of the Tenamache Mining Co., who recently returned here from the States, has just placed an order for reduction machinery for the Tenamache mines near Zopilote, Tepic, with the International Machinery & Engineering Co. of Mexico City. The order covers 10 stamps, re-grinding machinery, concentrators, cyaniding equipment, gas producers, and electrical equipment. It is planned to operate the machinery by electricity generated by the gas engines. The machinery will be delivered at the Pacific port of San Blas in time for its transport to the mines before the opening of the next rainy season.——L. C. Malone, of the Tajo Mining Co. (Jalisco), reports satisfactory progress in the development of the mine. The Las Boquitas orebody is exposed 7½ ft. wide, and assays 1100 gm. silver and 9 gm. gold, without sorting. The winze is showing up well, carrying 11 gm. gold, besides silver. Malone is not altogether pleased with the progress in the mill construction, as some of the necessary machinery got stalled at Etzatlán.——The Indé Gold Mining Co., Durango, have struck a deposit of free-milling gold-ore, which will add considerably to the supply available for its mill, the present capacity of which is 100 tons per day.——J. L. Saint Dizier, manager of the Encinillas Smelting Co., of Sta. Rosalia, has at last started the first furnace at three-quarters of its ultimate capacity, and will soon have it at full blast when the water supply is improved. This French company has contracts with the Naica to supply 2000 tons of ore per month.——When the Esperanza at El Oro has installed its 10 tube-mills for fine-grinding, the company will re-work its tailing heaps, which at present are merely washed by spent solutions.——The El Oro Mining & R. R. Co. has abandoned the use of imported pebbles in tube-mills and now uses hard quartz ore in rough 3-in. cubes; 53 lb. of these cubes, and 0.2 lb. of liner are abraded per ton of sand ground. The same company also made Christmas presents of half a month's pay to those employees of more than one year's standing.——The 50-stamp mill of the Amparo Mining Co., in the Etzatlán district, has been crushing 140 tons per working day. The value of the ore treated has been 433 gm. silver and 11.2 gm. gold per metric ton, and the total gold and silver extraction is reported as 92.8%. The company has lately declared a dividend of 2½% for the quarter.——The Mexican Copper Co., operating the Magistral claims in the Ameca district, State of Jalisco, has been incorporated in Washington by Patrick Clark, of Spokane, and his associates, for $1,500,000 in $1



Palmarejo, Chihuahua.

shares. A 2-compartment shaft has been sunk to a depth of 500 ft., and various drifts have been made in gold and copper-bearing ore. J. J. Stewart says that when these have been further developed the company will install a complete machinery plant.——The managers of the Palmilla mine will largely decrease the cost of pumping, and of extraction of their ore some time in April, when they expect to complete their drainage tunnel. Driving is being done with air-drills from both ends and progress is at the rate of 3 metres per day.——The Cinco Minas, in the Hostotipaquillo district, are being satisfactorily developed by Henry E. Crawford for the Marcus Daly interests; and it is now understood that a 5 or 10-stamp mill will be erected as a preliminary to the building of a 300-ton plant.——The Philadelphia Copper & Gold Mining Co., operating the San Vicente group of mines at San Martin Hidalgo, in the Ameca district, has cut a vein of the group in the No. 4 tunnel. An assay taken over a width of 6 ft. shows a value of $12. The manager, M. J. Slattery, now has a large tonnage of ore veloped.——News from the State of Oaxaca informs us that the Denny Bros. of South Africa are examining the San Martin gold and silver mines, near Ejutla.——Howard A. Kelly has acquired the entire holdings of the Oaxaca Milling Co. The mill is to be a custom mill for the treatment of ores of the Taviche camp, and will be completed as soon as the tests show the proper treatment. The mill when completed will cost about ₱300,000.——J. W. Brill, of the Tapada y Victoria mines, in the Totolapam district, has purchased complete equipment for a 10-stamp mill.

Special Correspondence.

NEW YORK.

Fink Furnace. — International Smelting. — Nickel Alloy. — Railroad from Tonopah to Ely.

Copper men are evincing great interest in the operation of the new Fink furnaces at Garfield, Utah. Samuel Newhouse, who is financially interested in the Fink patents, when in New York recently, stated that the initial trials of the furnaces were very satisfactory, and his enthusiasm for the new copper reduction process was so contagious that he succeeded in obtaining large financial assistance for erecting new smelters in Utah and Nevada, on copper properties he is interested in. These plants will be equipped with Fink furnaces, which are of the rotary type. Two such furnaces, capable of revolving at different speeds, and in opposite directions, are connected together. Fuel, such as oil, charcoal, sawdust, coke, or coal, is charged into one furnace, and the flame and gases are conducted to the next one. The object of such an arrangement is to permit the completion of smelting, bessemerizing, and refining in one operation. While the charge in the first furnace is being smelted and refined, the charge in the other furnace is roasted by the flame and heated gases from the first furnace. When the ores are rich in sulphur, very little extra fuel is required, and with suitable ore, the cost of smelting will be much below that of the ordinary hot-blast furnace.

The directors of the recently formed International Smelting Co. are busily engaged in completing the purchase of copper mines and smelters. During the past week they purchased the mines and smelters of the Compañia Metalúrgica de Torreón, Mexico. The price paid has not been divulged. It is stated, however, to have been high. The smelter, which has a capacity of 1500 tons per day, was owned by Mexicans, with Ernesto Madera as president. The Mexican company was capitalized at ₱2,500,000, and its stock sold at ₱150. Purchases of mines and smelters in the Western States involving the expenditure of $20,000,000, will be announced in the course of a couple of weeks.

The International Nickel Co. is taking advantage of the low price of copper to promote the sale of its nickel-copper alloy called Morrell metal. This alloy is composed of 70% nickel and 30% copper; it is suitable for use in boiler-tubes and in all places where corrosion of steel or iron may occur from steam or water. The company's smelter at Chrome, New Jersey, is working full time on Canadian ore. In addition to the demand for nickel for coinage purposes, and for plating, there is a large demand for alloys and for armor-plate. The company continues to pay 1½% quarterly dividends.

Those connected with the Tonopah & Tidewater Railroad Co. and the Nevada Smelting & Mines Co. are arranging to send out a new survey party to lay out the projected railroad from Ely to Tonopah. Recent developments at Ely, Tonopah, and Bullfrog have led interested capitalists to undertake the construction of the road immediately, before others grasp the opportunity. The Standard Oil people have invaded the Ely field and purchased controlling interests in the Giroux Consolidated, Cumberland Ely, and other mines. They have also purchased large interests in Utah copper mines and intend making Ely a great copper smelting centre. There will, consequently, be good prospects for those first in the field in building railroads connecting the copper and gold districts of Nevada and Utah, with Ely. The new Ely-Tonopah road will be about 207 miles long, and will cost $4,000,000. The completion of the road will reduce the carriage of Tonopah ores to the smelters by over 270 miles, the Steptoe plant benefiting at the expense of the Garfield smelter.

The New York mining market has been in a depressed condition since last October. In that interval there was very little activity in mining stocks of any kind, except Cobalt. Owing to syndicate operations the stocks of certain companies operating in the Canadian silver field were advanced a few points on several occasions, but even Cobalt stocks are now dull. At the present time, however, there is a stronger tendency in the market, and it is generally believed that activity will soon be noticed. The outlook is improving, notwithstanding the condition of the iron, steel, and copper industries. Speculators and investors feel that with general trade once more exhibiting prosperous signs, and with money abundant and cheap, they are warranted in again turning attention to mining. Many new schemes are being projected, and these will, probably, be shortly advanced by a return of activity in mining. The recently incorporated International Smelting Co. is active in purchasing mines at present, but rival companies will soon be in the field.

LONDON.

West Australian Dividends.— Le Roi, British Columbia. — Investigation of Cornish Mines.

Last week I submitted a list of dividends paid by the Rand mines during 1908. Similar calculations in connection with West Australian gold mines show that the dividends declared during the year have amounted to £1,424,362, which is a decrease of £227,156 compared with 1907, and of £565,465 compared with 1906. The largest sum distributed during any year was in 1905, when the dividends amounted to £2,079,324, though the figures for 1903 and 1904 were practically no lower. The drop in 1908 is accounted for largely by the impoverishment of the Oroya-Brownhill mine. Five years ago, Lake View Consols and Great Boulder Perseverance were also great producers, but they have now become low-grade properties. During 1908, Great Boulder Proprietary heads the list of dividend payers with a distribution of £262,500. Then follow Golden Horseshoe and Ivanhoe, with £240,000 each. After these come Kalgurli with £165,000 and Great Fingall with £106,250. These five are the only mines that have distributed over £100,000. The other chief dividend payers are the Associated Northern Blocks with £87,500, Associated Gold Mines with £86,688, and Great Boulder Perseverance with £70,000. The Great Boulder Proprietary, the Ivanhoe, and the Golden Horseshoe have reserves of ore that promise many years of prosperity. Decreased treatment-costs have made it possible to keep some of the impoverished mines going, and in one or two mines a better quality of ore has been met with, but, generally speaking, no important developments of ore deposits have been made in West Australia during the year.

As an example of the work done on low-grade ores at the present time in West Australia, the case of the South Kalgurli Gold Mines, Ltd., may be mentioned. This mine lies immediately to the west of the Great Boulder Perseverance, with the Kalgurli and the Great Boulder Proprietary on the north and south, respectively. Operations commenced in 1899, and for three years the ore yielded about one ounce per ton. The ore then changed in nature and value, so that new plant had to be provided, which was started in the summer of 1905. The treatment now consists of roasting, fine grinding, cyaniding by agitation, and filter-pressing. The amount treated during the 12 months ended September 30 last was 105,169 short tons, and the yield was 34,079 oz., valued at £144,459. The average yield was approximately 6½ dwt. per ton, equal to 27s. 6d. per ton. The working costs are given in great detail by the manager. The average mining costs come to 6s. $7^1/_5$d., and the metallurgical treatment to 12s. $4^2/_8$d. per ton. Development expenses were 2s. 9½d. per ton of ore milled, bringing up the aggregate costs to 21s. 9d. The total mining and treatment costs were £103,197, and of development £14,685. In addition, £1656 was spent in equipment, and £8222 allowed for depreciation. London and other general expenses came to £2733, leaving a profit of £15,549, out of which £10,000 has been distributed as dividend, which is at the rate of 5%; £5500 was written off the cost of development work in previous years. Great care is exercised in the study of costs, and continual improvements are being made. The costs for mining and

metallurgical treatment during November were only 18s. 2d. per ton, as compared with 19s. 0d. during the year ended September 30. The amount of ore reserves on September 30 was 121,868 tons, averaging just under 7 dwt., in addition to which there is probable ore estimated at 95,000 tons, averaging over 6 dwt. It is expected that in the future 5-dwt. ore can be worked at a profit.

After working for a year or more in rather poor ore, not sufficient to earn a profit, a better grade has been found in the Le Roi mine at Rossland, B. C., in the lowest or 1650-ft. level. Developments are being continued to open up these bodies of ore by means of winzes, and the ore now being shipped to the Northport smelter averages about $20 per ton. During the year and a quarter ended September 30 last, 100,444 tons were mined and smelted, the average content being 7¼ dwt. of gold, 0.55 oz. silver, and 1.22% copper. At the current price of metals the average value of this ore was $11.11 per ton. The loss on the operations was £24,895. The funds in hand on July 1, 1907, amounted to £154,509, and after deducting the loss mentioned, the directors have decided to write off the whole of the balance of mine-development account, amounting to £35,106, and the cost of options, £5475, two items left as part of the legacy of confusion from the old extravagant days. The balance to the credit of profit and loss account is therefore reduced to £89,032. The outlook at the mine is on the whole unchanged from what we have been accustomed to during the last few years, though of course the discovery of better ore at the lower levels is encouraging. On the other hand, the low prices of copper and silver are adverse factors, and ore with higher gold content is what is sought after. During the last year the services of W. A. Carlyle have been of value to the mine, in his capacity as consulting engineer. It is interesting to note that Mr. Carlyle's appointment to the professorship of metallurgy at the Royal School of Mines will not interfere with his professional practice in connection with the Le Roi or other mines.

The presence of an outside mining engineer in Cornwall is always to be welcomed, for it infuses new ideas. It is therefore of interest to note that your special contributor, R. Gilman Brown, is now studying the North Levant and Geevor properties, situated near Lands End, close to the Botallack and Levant mines. The mines belong to a company the control of which is with the same group as are interested in the Ymir mine in British Columbia, a mine that enjoyed Mr. Brown's services as consulting engineer for some time. Mr. Brown has acted in the same capacity for North Levant and Geevor and has recently joined the board. Mr. Oliver Wethered, chairman of the Ymir and of North Levant and Geevor, is also a director of Dolcoath and Wheal Vor, so that he has a close connection with Cornwall, and his introduction of Mr. R. Gilman Brown into the county is of special interest.

Mr. Brown came to the conclusion that too great a quantity of barren rock was being mined and milled at North Levant and Geevor. Accordingly he stopped development while arranging an improved method of mining. In the meantime the mill treated accumulated ore from the stopes and ore from the old dumps. On the chief orebody there is a shoot 400 ft. long and about 13 in. wide that carries 175 lb. of tin oxide per ton. Even when the lode is mined together with the necessary rock on either side, the ore milled can be brought to 60-70 lb. of tin oxide per ton. On another lode, the ore mined is about 45 lb. of tin oxide per ton, and the prospects in several parts of the mine are excellent. A new and up to date dressing-plant has been erected, consisting of two heads of Holman's air-cushion stamps (I do not like the name 'pneumatic stamps,' as it seems to be misleading), together with Frue vanners and Wilfley tables. The two heads together crush 50 tons of ore per day, and during October the cost of crushing and dressing ore came to 4s. 4d. per ton. While writing of Mr. R. Gilman Brown, I should mention that he is also investigating the Dolgelley copper mine, in North Wales, where the Elmore vacuum process is used for concentrating the copper ores. Mr. Wethered is a director of this company also.

ROSSLAND, BRITISH COLUMBIA.

Le Roi Report.—Power Interruptions.—Proposed Legislation.—B. C. Copper Co.—Silver King Abandoned.

The annual report of the directors of the Le Roi Mining Co., Ltd., recently read at London, shows a debit balance to profit and loss account, on the operations of the Le Roi mine and smelter for the 15 months ending September 30, 1908, despite the substantial profits earned during several months of the past fiscal year. The increase shown in the cost per ton of ore mined was caused by the heavy fixed charges being spread over a smaller tonnage shipped than during the previous year. The sum of £9701 was written off for depreciation. The company also paid off part of the indebtedness to the bank during the year. In arriving at this balance of profit and loss account the following amounts were also written off: for exploration and development, £27,108; sundry items of expenditure, £3995; the whole making a total of £40,804. The liabilities of the company on September 30 are shown as £65,326 and the assets amounted to £95,792, showing a surplus of liquid assets over liabilities of £30,466. This is considerably lower than for the previous fiscal year when the surplus of liquid assets over liabilities was £74,260; so that the report taken altogether is not one to delight the heart of a shareholder. There are some redeeming features, however, particularly in that portion of the general report contributed by A. G. Larson, the resident superintendent. During the fiscal year under review the Le Roi mine produced 100,444 dry tons of ore which averaged 0.363 oz. gold, 0.55 oz. silver, and 1.22% copper, figuring $11.11 per ton. This ore was richer than that produced in 1907, which carried 0.29 oz. gold, 0.44 oz. silver, and 0.98% copper, giving an average value of $10.49, or 62c. per ton less than during last year, even though during part of 1907 abnormally high prices were obtained for most of the copper and silver produced. It is estimated that the ore produced during 1908 was worth about $1.40 per ton more, on an average, than during the previous year. It contained about 5 lb. more copper than in the previous 12 months, but the cost of extraction was greater, since much of the ore was taken from the smaller stopes in the mine. The Northport smelter produced 2780 tons of matte, having a value of $1,164,912, or $418.97 per ton. The smaller tonnage treated ran the costs up a shade at this point also, the fixed costs in connection with the smelter being heavy. It is a moot question whether or not the company would not be better off to swallow the bitter Northport smelter pill, dismantle the works there, and ship the product of the Le Roi mine to the Trail smelter, where it is said a rate can be obtained that is much cheaper than the cost of treating Le Roi ore at Northport. The Le Roi mine last year produced enough good ore to pay dividends to the shareholders, but with the fixed expense of the smelter and of the London office the balance is on the other side of the page. While it is impossible to adjudge fairly without knowing all the inside facts it looks to an observer as though it would pay the shareholders to dispose of the Northport smelter and the London office, with attendant traveling expenses to and fro. It would be safe to wager that the financial statement of the company would show a good profit in a comparatively short time.

During the recent spell of zero weather the power-plant of the West Kootenay Power & Light Co., at Bonnington Falls, was compelled to stop work for several days owing to trouble with the slush and ice in the Kootenay river; as a consequence the mines of Rossland and the Boundary district were compelled to cease operations for the better part of a week, which will result in a lessened production of ore from these districts for January. Being closed down many of the mines undertook repairs, which will cut into the profits to quite an extent. The Le Roi No. 2, Ltd., during the month of December shipped 1995 tons of ore from the Josie workings, from which the smelter receipts were $24,759, and 73 tons of concentrate, from which the company received $744.

At the eleventh annual convention of the Associated

Boards of Eastern British Columbia, to be held at Trail, resolutions will be introduced by Nelson and Kaslo representatives, suggesting that the leases on mineral claims cease at noon instead of at midnight as at present; that "in contemplation of the production of spelter in quantity by the new electric process now operating at Nelson, B. C.," representations be made to the proper Dominion authorities toward the necessity of a re-arrangement of the duty upon zinc products entering Canada and "to the necessity of seeking, through the medium of Canadian trade channels, possible markets abroad." These are the principal resolutions that will be proposed which affect the mining industry.

About 250 men are working in the Mother Lode of the British Columbia Copper Co. This is a much larger force than the company finds it necessary to work underground in the summer when glory-hole mining is more easily carried on. Ore of greater richness is extracted from all of the big Boundary mines during the winter months than during the summer. The reason is that the ore is more carefully picked from the different stopes, and there is a better opportunity to sort it than when thousands of tons at a time are broken down in the glory-holes. This feature is an important factor in mine accounting in the Boundary. It is stated by P. F. Roosa, manager and provisional liquidator of the Dominion Copper Co., that he expects to see work resumed at the company's mines in about six weeks. The machinery at the Boundary Falls smelter is being kept in good condition, so that work may be started without delay. The pumps have been kept going in the mines since the cessation of work so that there has been no accumulation of water.

At Nelson the unwatering of the Silver King mine from the fifth to the tenth levels is being rapidly accomplished, and as soon as this has been finished the force will be augmented and development continued on a larger scale. There is little doubt that the Silver King can be made to pay if untrammeled by the Nelson smelter, which has been a losing business for a long time and has dragged the mine down with itself. The bond which F. A. Erlund and associates have had upon the Queen Victoria mine was released the other day when a payment of $15,000 became due. This was a surprise to local mining men, as nearly $60,000 had already been spent by the operators and the Queen Victoria has been looked upon as one of the coming low-grade mines of the district. The deposit is the largest low-grade copper mass in this district aside from the Rossland mines.

BUTTE, MONTANA.

Copper Production. — Smoke-Case Decision. — British-Butte Claims Sustained.—Gold-Dredge Started.—Calumet-Corbin Capitalized on Options.—Mine Protective Legislation.—Concentrating Plant.

With the Boston & Montana Co., the largest producer of copper operating in the district, closed for 11 days during the month, the Butte mines produced 26,502,608 lb. of copper in January, or nearly 2,500,000 lb. less than was produced by the district in December. The different companies contributed to the totals of ore mined and copper produced approximately as follows:

Companies.	Ore, Tons.	Copper, Lb.
Boston & Montana	70,000	5,250,000
Anaconda	112,840	7,108,920
Butte & Boston	20,770	1,287,740
Washoe	17,050	1,023,000
Parrot	12,555	728,190
Trenton	13,578	760,368
North Butte	43,400	3,992,800
Butte Coalition	38,750	3,138,750
Original	28,055	2,188,290
Pittsburg & Montana	8,370	627,750
Miscellaneous	4,960	396,800
Totals	370,328	26,502,608

The average daily output of ore from all the mines was 13,188 tons, and of copper, 948,068 lb. The yield of copper per ton of ore was, approximately: Boston & Montana, 75 lb. per ton; Anaconda, 63; Butte & Boston, 62; Washoe, 60; Parrot, 58; Trenton, 56; North Butte, 92; Butte Coalition, 81; Original, 78; Pittsburg & Montana, 75.

In deciding the Washoe smelter-smoke litigation, and refusing to close the big Washoe smelter by injunction, Judge W. H. Hunt of the United States Court removed a depressing cloud that had hung over the copper mining industry in Montana for four years, and put new life and courage into the mining community. He does not deny a remedy to the 107 farmers who tried to close the mines and smelters, upon the continued operation of which 100,000 people directly and indirectly depend for a living, but he holds that the damage done to the farms is infinitesimal compared to the general damage that would result by the issuance of the injunction. He holds that if the farmers have suffered damage on account of the smelter-smoke, they have a sufficient remedy at law, and that the company is able to respond in damages. As a fact, however, Judge Hunt has found that comparatively little damage has been done by the smoke, and practically none is being done now. He finds that the Amalgamated Co. has been striving constantly to improve conditions and to lessen the damage from smelter-smoke, and that the farmers, in order to bolster up their case for injunction and to force the company to settle with them on their own terms, used as exhibits a number of heads of livestock that were sickened years ago, and for which the company had paid in damages the full value of the stock. These poor specimens of horses and cattle were, nevertheless, kept by the farmers and exhibited to Judge Hunt himself when he visited the farms during the trial of the injunction-suit, as evidence of what the farmers were suffering. Judge Hunt observed that, aside from these particular specimens, the finest looking live-stock he ever saw in Montana thrived in the 'smoke zone'. The farmers had demanded from the company that the latter purchase outright all their lands, improvements, and so forth, setting a valuation on the property of $1,120,731, representing 90% of all the lands in the Deerlodge valley and in the smoke zone. Against this stands an investment in the smelter alone of $10,000,000, while all of the city of Anaconda and 60% of the city of Butte are directly dependent on the continued operation of the smelter and the mines. The judge also finds that the company pays 51% of the taxes of Deerlodge (Anaconda) county, and about 30% of all the taxes in Silver Bow (Butte) county. Because of these and other facts cited, the court held that there would be no equity in the granting of the injunction. The decision also is an effective reply to the representations that had been made to President Roosevelt a few weeks ago, that the smoke was destroying the timber on the National Forest Reserves, which prompted the President to take steps to order injunction proceedings against the smelter, which order was afterward recalled. The evidence now brought out disclosed that some arsenic still escapes from the chimney of the smelter and does some damage, and Judge Hunt will personally conduct another investigation, beginning February 15, to ascertain whether this damage can be lessened. The officers of the Amalgamated will do everything possible to assist the court in this inquiry. The company has had several high-salaried experts engaged for several years in studying the problem in all parts of the world. Every improvement at the Washoe smelter has been made on the recommendation of these experts, and enormous expense has been incurred to abate the trouble.

The long contest over the applications of the British-Butte Mining Co. for patents to six of its placer claims at Rocker, west of Butte, has been decided by the special agents of the Interior Department sent to Butte last year to conduct an investigation. The charges of the Government were not sustained, with the exception as to four of the claims, on which insufficient work had been done before application for patent was made. Since then, however, the work has been done, and it will only be necessary to renew the applications. The gold dredge was started Saturday, January 31, with spectacular ceremonies, presided over by Governor Norris and a brass band.

The re-organized North Butte Extension Development Co. is again in trouble. It has been stated that the new company had paid $30,000 on the options, but that only $5000 has been paid, and the long promised resumption of work has not yet taken place.

The Calumet-Corbin Mining Co., one of the latest concerns organized to do business in the Corbin district, has already offered its stock on the Eastern curbs, although it does not own the property on which it has been organized and capitalized for $1,500,000. It has a long-time option on the old Minnesota mine, on which, it is reported, a payment of $2000 has been made, and not another payment need be made until next fall. The Minnesota was considered worked out many years ago, but the present owners hope to develop new orebodies.

A most important bill is pending before the legislature of Montana to protect and promote legitimate mining enterprises. It will be made a felony for anyone to sell stock in a company that does not own the property on which the capitalization is based, unless it is specifically stated and represented that the company is but a leasing company and does not own property. Several years ago a number of mining companies were floated on leases and bonds and options, but the public did not know it until the stock was purchased and the promoters had forfeited the options, leaving the deluded and defrauded stockholders to 'hold the sack'. The companies and their officers protected themselves behind the excuse that they did not represent that they owned the property.

The Butte-Montana Mining Co., owner of the Alex Scott mine, is contemplating the erection of a concentrator at the mine. It is proposed to change the capitalization from 1,000,000 shares at $1 par, to 125,000 shares at $10 par. If the stockholders consent to the change, the necessary capital can be obtained.

The stockholders of the Butte & London Development Co. have elected the following directors: Frederick W. Baker, representing the English interests in the company, James A. Talbot, W. W. McDowell, W. E. Reynolds, A. A. McMillan, James H. Lynch, Fred Whiteside, T. H. Emery, Guy W. Stapleton, and E. J. Anderson, all of Montana. Splendid progress is being made by the East Butte Mining Co. to place that property on a paying basis.

MEXICO.

Purchase of Torreon Smelter.—Price Paid.—Probable Policy.

Report comes from New York that the International Smelting & Refining Co., the new company which is supposed to be a competitor of the American Smelting & Refining Co., has purchased the smelter and mines of the Torreón Metallurgical Co. for $3,000,000. This will include the smelting plant at Torreón, Coahuila, Mexico, the mines and mill of San Diego, at Santa Barbara, State of Chihuahua, the lease on the Cabrillas mine, near Saltillo, Coahuila, and other smaller mines, and leases in the northern part of the Republic. It is known that some month ago L. D. Ricketts and E. P. Mathewson were in Mexico and visited or examined the properties of the Torreón Metallurgical Co., which is largely controlled by Ernesto Madero, its president, and it is not at all improbable that a sale has been consummated, but the price named seems absurd to those familiar with the conditions. About three years ago, at the summit of the Torreón company's prosperity, the stock was quoted at ₱150, with 35,000 shares, or a then valuation of ₱5,250,000. At that time it was reported that the American Smelting & Refining Co. was negotiating for the Torreón smelter, and it was generally understood at the time that ₱4,500,000 had been offered, but that ₱5,000,000 was demanded. The A. S. & R. Co. continued work on the Velardeña plant, not far distant from Torreón, in the State of Durango. Since then the stock of the Torreón company has continually declined, until on the day when the abovementioned sale was reported it was quoted at ₱80. This makes a total valuation of ₱2,800,000. It is not probable that the interests behind the International Smelting & Refining Co. would pay $3,000,000 for what could be had for less than half that figure. That the sale was consummated at a much lower figure is not improbable, for the smelter of 10 stacks is not a bad one, and some of the mines are of enough merit to be attractive to the buyer. The time was propitious then for the transaction. If it has been carried through, it is hard to predict how the smelting business may be affected. Up to the present the independent companies have worked amicably with the A. S. & R. Co., and it is not probable that a new concern, even though fortified with immense capital, can afford to enter the field with a cut-throat policy.



Map of Mexico.

PIOCHE, NEVADA.

Ore-Shipments.—Lead-Zinc Discoveries.—Smelter for Bullionville.—Prince Mine.—New Management at Day Mine.

In the late seventies a prominent mining man at Lake City, Colorado, said: "The San Juan country must soon begin shipping, or stop blowing." Fifteen years later I rode on horse-back through San Juan with a mining engineer, then manager of the great Enterprise mine at Rico and the Yankee Girl at Red Mountain, each with millions to its credit. This mine manager, then also State Geologist of Colorado, had traveled around the globe studying ore deposits and examining mines, and I was deeply impressed with his remark, "Where in the world could one find a mining region of greater interest or promise than this?" San Juan had 'made good'. Its Smuggler, Enterprise, Sunnyside, Guston, Virginius, Yankee Girl, Ute & Ulay, Golden Fleece, and a hundred others, had shipped. Its promise has since been further fulfilled in the Camp Bird, Gold King, and other mines of lesser note. Similarly, Pioche in its early period was a great producer, but we are interested now in its loudly heralded renaissance. It is time for Pioche to begin shipping, stop blowing, or tell the reason why.

The year 1908 opened in a serious financial stringency, with metals declining and markets depressed. To secure money for development was nearly impossible. Every smelting company in Utah, except the A. S. & R. Co., had been put out of business by the courts. The A. S. & R. Co. was not overlooking such opportunities, and advanced its treatment charges to exorbitant and in some cases to prohibitive figures. The Salt Lake railroad made Pioche liberal concessions in freight rates. The A. S. & R. Co. promptly absorbed the benefit, and more. Under such circumstances, mine owners in the camp considered it sounder policy to keep their ores in the ground than to take them out. During the year considerable development was done, but the entire year's shipment from Pioche was only 12,000 tons. This tonnage came principally from the Nevada-Utah's Day mine, the Bristol Consolidated, and the Mendha. The Boston & Pioche, Highland Mary, and Prince Consolidated each shipped a few cars. Not a pound of ore has gone out from the old hill south of town, which made the reputation of the camp in the early seventies. There are known ore-shoots of great value in the ground on that hill, which the Nevada-Utah owns exclusively, but considerable development and more equipment will be required before these can be extracted. The rest of the hill the Nevada-Utah and Ohio-Kentucky companies own between them. There is a tangle of titles which can be unraveled only by litigation or compromise. As matters now stand, for either of them to begin shipping would invite litigation. Negotiations for a compromise have been under way for several months. Until these are definitely concluded the general public will not be admitted to confidence. Another element of moment affects the question of shipping. In the Susan Duster mine the Ohio Kentucky Co. has found between the surface and the 400-ft. level an enormous tonnage of lead-zinc ore carrying silver. Any economic solution of the problem to fit present metallurgical practice will involve a plant for mechanical separation of the ore into lead and zinc products. If such a plant can be erected near the Susan Duster, the lead product could be utilized for a smelter at Bullionville, 12 miles north of Pioche. The Prince Consolidated Mining & Smelting Co. owns the Prince mine, and also the old tailing stored at Bullionville. These tailing-beds were carefully measured and sampled some years ago by Richard H. Browne of Salt Lake, who reported 170,000 tons, carrying over $2,000,000 in gold, silver, and lead. The great tonnage in the Prince mine runs low in silver and lead, but carries a high excess in iron and manganese. Many other ores of this region carry lime in large excess. The Prince Consolidated is controlled by the same interests that dominate the Ohio Kentucky. These interests have been devoting their attention mainly to planning a smelter at Bullionville, where the lead from the Susan Duster, the iron from the Prince, the silicious ore from the Mendha, and the lime ores of the district, could be assembled and smelted with the old tailing. The plan is logical, and will probably be worked out with some modifications.

At present everything on the hill is closed tight, and probably will remain so, awaiting a compromise. When that is effected it will involve a lead-zinc separating plant which will treat the lead-zinc ores of the Nevada-Utah as well as those owned jointly by the Nevada-Utah and Ohio Kentucky. As generally occurs in ore-shoots having rich silver-lead ore near the surface, the companies that mined here in the early days found lead-zinc ore in their lower workings. From what can be learned of the records of those days, it is warrantable to believe that an enormous tonnage of lead-zinc ore will yet come from those old mines. This, as well as the recently discovered lead-zinc ore from the upper horizons in the Susan Duster, must all be treated in local plants; at least they must be enriched by mechanical concentration.

Those familiar with the conditions here believe that one of the largest zinc industries in the United States will some day be developed in southern Nevada, but Pioche will not have to wait for that. Until a zinc plant is erected in this county, zinc concentrate can be profitably shipped to outside markets. Up to last summer the Prince was being developed as a low-grade proposition. One day a cross-cut, driven by Wm. Lloyd from the third level for general results, cut a vein carrying silver chloride and lead carbonate. This discovery gave an entirely new outlook for the property. Further exploration on the second, third, and fourth levels has demonstrated not only the continuity for 200 ft. vertically and 300 ft. longitudinally of the vein above-mentioned, but it has disclosed two other veins. In this case the theory so fondly cherished by the prospector has been verified. The veins have grown richer and wider with depth. On the fourth level, from a vein 8 ft. wide in places, they have taken out in ton lots ore running over 1000 oz. silver per ton. No stoping has been done, and only a portion of the ore taken from the drifts and raises on these veins has been brought to the surface. Three 50-ton cars have been shipped, but the returns have not been made public. The treasury of the company has abundant money for immediate needs, and the management has announced the intention not to ship ore in quantity until a spur track shall bring the railroad car to the mine, and until other conditions are more favorable. Meanwhile development proceeds. The main shaft has been sunk, and a cross-cut is being driven from the 550-ft. station toward the rich veins.

James P. Gaskill, chief engineer and general Western manager of the Nevada-Utah, has during the past year devoted his entire attention to the Day mine, 15 miles northwest of Pioche. After shipping several thousand tons of ore as a test and means of studying the conditions of ore occurrence, he stopped shipping and opened the mine by what is known as the Onondago shaft. The collar of this shaft is so situated that the cars run from it 100 ft. and dump directly into the ore-bins. Here the ore is loaded automatically into the company's narrow-gauge railroad cars. Formerly it was sent down on a wire tram. The ninth level connects with this new shaft. All the ore comes through that level and up the shaft. A compact well arranged power-house at the shaft completes the plant. Mr. Gaskill says that when all arrangements are perfected for normal production he expects to put ore into the cars at Pioche for 75c. per ton. J. A. Gallagher was appointed by Mr. Gaskill as mine superintendent last October. Mr. Gallagher will be remembered as the man who was called from the Cumberland-Ely a few months ago to superintend the rescue of the miners imprisoned in the Alpha shaft of the Giroux mine, at Ely. On December 31 L. Webster Wickes resigned his position as general superintendent for the company, and his duties were assumed by Mr. Gaskill and Mr. Gallagher. Shipments were resumed January 2, and a 50-ton car has gone out regularly each day since.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Engineer as a Financier.

The Editor:

Sir—In your issue of January 9, in discussing under the above heading your comments upon Mr. Hammond's recent essay on professional ethics, J. R. Finlay illustrates the difference between purely technical and commercial engineering reports by quoting from the technical report of Engineer Smith and the commercial report of Engineer Brown, both reporting on 160 acres of coal land of Farmer Jones. It cannot be thought that the illustration is based upon an actual occurrence, and we must assume that it was formulated merely to illuminate the difference between essentially technical and essentially practical engineers. For this purpose it may be allowed to stand; as between engineers it will not be misunderstood; but that the financial and commercial world may not be misled as to what happens when an engineer undertakes to advise his clients upon the financial and economic aspects of coal-mining investments, and for the protection of engineers who specialize in coal-land examinations and in the appraisal of coal-land values, it seems essential that the illustration used by Mr. Finlay be properly explained.

While the mining of coal involves fewer uncertainties as to mineable quantities and has certain elements insuring greater stability than the mining of most other minerals, yet the risk and uncertainties that affect the cost of mining, the commercial risks ever present in selling coal, in collecting outstanding accounts, and in transporting coal to market, are such that few capitalists would for an instant consider the purchase of coal property at a price which at best would be returned with compound interest at 6% after a period of ten or eleven years. Yet this is 'Brown's' advice: that the property in ten years will produce a gross profit of $250,000, and that its present money value is $125,000. After one experience with 'Brown', his clients would find it more profitable to employ 'Smith', study his statements of fact, and draw their own conclusions as to money values.

In reporting upon coal lands, the engineer usually has a distinct understanding with his clients as to the nature of the desired report. The determination of what should be covered by his report is seldom left to the engineer. If the report be made for coal operators or corporations contemplating purchase, a monetary appraisal of value is rarely required or desired; the clients in such cases usually wish merely to have the facts as to quantity, quality, and mining conditions (faults, etc.), being themselves able to deal with the economic questions involved in the transaction. If the examination be made for owners who desire to sell, an appraisal may not be needed, this being left to the judgment of the purchaser, and to the ability of a shrewd middleman to lead the purchaser to appraise its value at the highest attainable price. If, however, the investigation be made for purchasers who are not practical coal men, or if the report is to furnish a basis for a bond or stock-issue, appraisals of value and estimates of yearly and aggregate profits, and of the life of the property, are generally needed. Before undertaking a coal land examination it is usual for the engineer to come to an understanding with his clients as to the scope of the proposed examination and report. In my own experience this always has been a simple matter, for I have found that my clients usually know exactly what they want the report to cover. Unless an appraisal of value be desired, or advice must be given based upon such valuation, no engineer will gratuitously make an appraisal; for the determination of the present money-worth of coal lands is the most difficult problem for those devoting themselves to this branch of mining work.

The formula 'Brown' offers as applicable to properties that can be worked out in ten years is of seductive simplicity; thus,

Let x = present money value.
a = tons of mineable coal.
b = profit per ton.
then

$$x = \frac{a\,b}{2}$$

'Brown' hesitates to commit himself definitely only upon one point, and that happens to be the one thing of which he should be most sure. He says that, in his judgment, the "farm can be depended upon to produce 1,000,000 tons of coal," but states positively that it can be mined for $1 per ton, can be sold for $1.25 per ton, can be worked out in 10 years at a total profit of $250,000; and says he computes its present value at $125,000. Variations in market price, competition with other fuels, and other producers, car troubles, strikes, lawsuits, accidents, explosions or other mine disasters, variation in freight rates and in the wage-scale, must ever prevent the appraisal of coal land upon any such basis. With the normal interest rate yielded by good, or even 'gilt-edged' investment securities ranging from 4 to 5% per annum, no coal property which (barring accidents or revolutionary change in economic conditions) presumably can be exhausted in 10 years can be appraised at a value upon which it will return only 6% compound interest. If 'Smith' had been asked to include an appraisal of value, statement of yield, mining profit per ton, and the like, his report might have read about as follows:

"As the ash-content of the coal is high, namely, 10%, the coal will not make coke good enough to command ready sale at satisfactory prices. If coke is to be made, the coal must be washed, and this will increase the cost and may not produce an article of satisfactory quality. In the absence of coking and washing tests, I therefore advise that the coal be marketed as a steam and heating fuel. Competition in the general market with other better coals will probably keep the profit normally down to between 10 and 20c. per ton, except in times of great industrial activity or during coal strikes in other districts.

The property will yield an aggregate tonnage of between 1,100,000 and 1,200,000 tons, based upon a yield of 1200 to 1300 tons (of 2000 lb.) per foot-acre, which, under fairly efficient management, will certainly be realized. It will not, in my judgment, be safe to estimate the average net profit at more than 18c. per ton, upon which basis the total profit will be about $200,000 to $215,000; but, having in mind the high ash-content of this coal, it would perhaps be more prudent to estimate the net profit at 15c. and the total profit at $165,000 to $180,000. In making these estimates I have charged to cost of mining a sum sufficient to provide a sinking fund to repay the cost of the necessary plant and improvements. The latter will cost approximately ——— thousand dollars, based upon a capacity of 350 to 400 tons per day, which will be the average output if the property is to be exhausted in 10 years. Basing my estimates of value solely upon this one vein which underlies the property, and disregarding the present market price, which may be purely speculative, of similar property in the same neighborhood, I should appraise the present money value of this property at about $200 per acre, or say $32,000 for the 160 acres."

Doubtless 'Smith' would not make an appraisal upon such meagre statement of fact. He would require a determination of the phosphorus in the coke, and of the sulphur in the coal and coke, and might require data as to the dip, water, gas, and other things, with all of which Mr. Finlay will doubtless agree. The writer merely desires to emphasize the necessity for careful revision of articles written by engineers for publication in technical journals. If such articles were read solely by engineers, a certain looseness in writing might be permissible, but as they are doubtless read by thousands of non-technical readers, it is most important that they be couched in language that will not be misconstrued or misunderstood.

H. M. Chance.

Philadelphia, January 19.

[Mr. Chance has accentuated the eternal truth that two heads are better than one. Mr. Finlay gave an illustration, and it illustrated his point; Mr. Chance has given an example which we may call exemplary! One supplements the other nicely, but it must be remembered that illustrations are never exact, either in explication of a principle or in erection of a parallel. They share the inherent defect of metaphor. But they enlarge the view and throw light upon a conclusion that else might be obscured in the heaviness of plain argument. We do not think that revision of articles should extend to these details. The personality of the author is worth something; his fallibility is as instructive a warning as the editor's —and as useful. It is not infallibility that keeps the world lively with opposition. That would place a period, and call for adjournment *sine die*.—Editor.]

Coating Cyanide Vats.

The Editor:

Sir—I have heard of a preparation made of tar, rosin, and beeswax for coating cyanide vats, but do not know the proportion of each ingredient. This mixture is to be made thin, I understand, and applied hot. First a coat is applied to the boards; then a 6-in. strip of 8-oz. duck is spread over, tacked down, and thoroughly painted on top. It is said to act like glue. Can you give any further points regarding such a lining.

R. H. Fraser.

Reno, Nevada, January 20.

Price of Silver.

The Editor:

Sir—Lately the price of silver has been a grave question to those interested in the production of that metal. During the past year the charge of silver mine operations has formed a part of my work, and with the end in view of obtaining a basis of judgment of what might be depended upon in the way of a possible average price of the metal during operations for the next ten years, I worked out the following data of averages for the 11 years from 1897 to 1907, inclusive. This may be of interest to others. It will be noted that, without exception, the average for the second half of each year is lower than the average for the first half. From the tendency of the price now, after the recent depression, history seems again to be repeating itself.

	First Half-year. Cents.	Second Half-year. Cents.	Difference. Cents.
1897	64.75	51.48	13.27
1898	61.46	54.23	7.23
1899	62.68	58.46	4.22
1900	65.57	58.58	6.99
1901	64.18	54.08	10.10
1902	56.69	47.00	9.69
1903	61.89	47.00	14.89
1904	62.00	53.00	9.00
1905	65.84	55.18	10.66
1906	71.75	62.62	9.13
1907	70.12	52.13	17.99

	Cents.
Average price for the first half of the 11 years	64.26
Average price for the second half of the 11 years	53.96
Average price for the 11 years	59.11
Average difference between half-year averages	11.188

Ernest A. Haggott.

Los Angeles, January 8.

California State Mining Bureau.

The Editor:

Sir—The comments on the California State Mining Bureau appearing in the editorial columns of your journal during the past year have been read with great interest by many of those who have the good of that institution, and the mining industry of this State, at heart.

As your correspondent was the first person to call the attention of the public to the deplorable condition of the Mining Bureau, and cannot believe that this condition will ever be materially changed through the instrumentality of the California Miners' Association, but must be brought about by other means, the following statement is submitted to the readers of your paper in the hope that it may help to point out the way to the removal of a condition which is a disgrace to one of the greatest mining States in our Union.

Some years ago your correspondent was asked by the present State Mineralogist to take the position of Curator of the Mining Bureau museum and Secretary of the board of trustees. This position was accepted upon the understanding that all the efforts of the Bureau should be directed toward doing the best technical work of which the funds available would allow. After being connected with the Bureau for nearly a year, during which time it developed that political influence, and not the good of the mining interests of the State, was to determine the selection of the Bureau employees, and the expenditure of the funds provided for fostering the mineral industries of the State, your correspondent found himself in a position in which his self-respect and regard for his professional reputation would not allow him to remain. He therefore resigned.

Some time later, through an interview given to the San Francisco *Chronicle*, the attention of the public was directed to the deplorable condition of the Mining Bureau. In that interview attention was called to the fact that the State Mineralogist was filling important positions, which required men of good technical training and experience, with political hangers-on, and his own relatives, who were in no way fitted for the work they were supposed to perform; that the Bureau library was uncatalogued and so ill arranged as to be of little service to those who wished to make use of it, and that no effort was being made to improve its condition; that in the preparation of the bulletin on the 'Copper Resources of California', no part of the work of authorship was performed by the State Mineralogist, and yet he had brought it out as 'The Copper Resources of California,' "by Lewis E. Aubury, State Mineralogist," and that its pages contained no recognition of the work of some of those who had contributed the portions of the highest value; that the bulletin on the 'Saline Deposits of California' was unreliable as a source of information, that it was written by an employee of a corporation floating a company to exploit certain alleged nitre deposits in southern California, and was devoted largely to a description of the company's holdings, and so forth.

The day this interview was published in the *Chronicle* your correspondent was approached at the opening session of the annual meeting of the California State Miners' Association by a past president of that association, who was then president of the board of trustees of the Mining Bureau, and he demanded of him: "What do you mean by that interview in the *Chronicle*?" and in the conversation following he made this remark: "Before we get through with you, you will be mighty sorry you started this thing." He later returned, saying that there would be a meeting of the board of trustees of the State Mining Bureau that noon in which the whole matter would be gone into thoroughly. Your correspondent accepted the cordial invitation given him to be present and at the appointed hour repaired to the meeting place with the documentary evidence of the case, having taken the precaution to have a private stenographer accompany him in order that he might have a record of the proceedings of the meeting, and might not be done the injustice of having anything he might say misquoted. The president of the board objected to the presence of the stenographer, although he had invited a reporter to be present whose report of the meeting he knew would be satisfactory to the forces that dominate our politics. During the discussion of this matter one of the trustees aptly remarked that it was much easier to start an investigation than to stop one after it was started. The upshot of the matter was that the board adopted a resolution to the effect that they would pay no attention to the charges that had been made and adjourned without looking into the merits of the case at all.

A day or two later the State Miners' Association adopted a resolution, as was their annual custom, endorsing the State Mineralogist and approving of the administration of his office.

The criticisms of the Mining Bureau which have appeared in the editorial columns of the MINING AND SCIENTIFIC PRESS have been mild and conservative in comparison with what the condition of the Bureau would justify. Since the attention of the public was first directed to the condition of the Bureau matters have gone from bad to worse; the efforts of the State Mineralogist have been chiefly directed to aiding the Southern Pacific to fight the Western Pacific; the foremost authority on mining statistics on the Coast has been discharged to make place for a newspaper reporter who has won favor by his frequent laudatory references to the great work of Lewis E. Aubury; the same spirit that prompted the attempt to steal the honor of writing the bulletin on the 'Copper Resources of California,' and which, in describing the ancient lakes of the desert region of southern California, inspired the author of the bulletin on 'Saline Deposits' to name the largest and most important one Lake Aubury, and a lesser one Lake Le Conte, has placed the name of Lewis E. Aubury in every conspicuous place possible, even going so far as to have new labels made for all of the specimens in the museum, collected during the whole life of the institution, so that each label might bear the name of "Lewis E. Aubury, State Mineralogist." It is no wonder that one after another of the prominent mining men of this State who have accepted an appointment as trustee of the State Mining Bureau have resigned after they have become acquainted with the conditions at the Bureau, and have found that the forces dominant in our politics have so organized matters that the trustees can do nothing to rectify the conditions.

The present State Mineralogist is well along in his second term of office and his maladministration has long been a matter of public scandal. Where, during all these years, has the State Miners' Association been, that it has not taken this matter up? The California State Miners' Association died a natural death when the real miners of the State wearied of supporting an organization used solely by certain of its officers as a means of fostering their political ambitions. May its ashes rest in peace! That it may ever be resurrected to put the Mining Bureau on a

worthy basis will not be held as a reasonable hope by those who know the inside history of its last years.

To your correspondent, who has given this subject much earnest thought, there appears to be but one way of removing the Bureau from politics and making it of real service to the mineral industries of the State. In a number of States the work of a geological survey is carried on under the direction of a member of the faculty of the State University. The president of the University of California and the faculty of the mining and geological departments of that institution deserve and enjoy the confidence of the people of the whole State. If the present organization of the Mining Bureau were abolished by law and the collections, library, apparatus, and equipment of the Bureau were put in the care of the authorities of the State University, with the understanding that the Bureau, museum, and library should be maintained in San Francisco for the benefit of the public, we could be certain that the force necessary to carry on this work would be made up of the best men available, and that the funds devoted to the work would ensure the greatest possible results.

The exact figures are not at hand, but if your correspondent's memory is to be relied upon, the State has during the life of the Mining Bureau placed nearly half a million dollars into the work carried on by that institution. When we consider what that amount of money could have accomplished if it had been used to the best advantage, we must realize that a change should be made at once, so as to enable the State to derive all possible benefit from future appropriations devoted to this work.

JAMES M. HYDE.

Paradise, California, January 21.

Amalgamation Methods.

The Editor:

Sir—In your issue of December 12 under the above caption, Mr. H. W. MacFarren remarks as follows: "Patent amalgamators to follow plates may be of advantage in some cases, but usually not, as it is the amalgamator's business to see that there is nothing left that can be caught by amalgamation, consequently they should only be put in on trial." In the majority of the mills of the country where the ore will amalgamate there are particles of gold that cannot possibly be caught on the ordinary plates. If Mr. MacFarren is ignorant of that fact, I would suggest that he experiment a little with patent amalgamators and find out for himself. In a mill at Black Hawk, Colorado, I made a 3½-day test below the plates with my amalgamator on ore averaging $3 per ton. In that test the millman saved 2 oz. 9½ dwt. In the Pierce machine, below the plates and quicksilver traps, I caught 2 oz. 9 dwt. On another test in the same mill, on ore running considerably higher, the saving was in about the same proportion as the first test. In each test the millman or amalgamator claimed I had 'salted' my machine, as he had been in that district for 32 years and "knew" that he was not losing that amount of gold. The "patent amalgamator," as Mr. MacFarren would term it, told the story.

Robeson & Carter, lessees of the Smuggler Union mill, at Telluride, Colorado, saved over $66,000 in 11 months below the plates and quicksilver traps; the Pierce machines paid for themselves over 30 times, and in 23 months saved $106,580. After the Smuggler people had made such a great saving the Tomboy ordered fourteen 25-ton sets for their mill.

These machines are doing good work below the plates and traps in other parts of the country, and in places the millmen are installing them in place of plates. Mr. MacFarren seems to be of the opinion that no improvement has been made or can be made over the ordinary plate. He also seems to think that whatever is new is wrong, and that experiment means disaster. When Wifley first introduced his concentrating table on the market the wise ones said: "It can't be made to work." But it did work. When I tried to introduce the Pierce amalgamator in certain mills I was met with the rebuff: "It's no use, we are not losing any gold. I have been here for 32 years, and I know. It's simply time and money wasted experimenting with these new fangled amalgamators." But in the face of such opposition these machines are taking the place of plates.

LUCIUS S. PIERCE.

Denver, December 19.

Power in Stamp-Milling.

The Editor:

Sir—On my return to San Francisco, I noticed an article in your issue of December 5, 1908, entitled 'Stamp-Mill Practice on the Mother Lode', by Alex Chalmers. Mr. Chalmers stated at length the many interesting features of the new mill, without making specific comparison with the old mill. The power consumption of the new mill, however, as stated by Mr. Chalmers, cannot be correct: "The 20 stamps, 12 Frue vanners, 36 ft. of 4-in. mill line-shafting, and 34 ft. of 2-in. concentrator counter-shafting consume 40 horse-power." "The stamps weigh about 1000 lb. each, and are given a drop of 7 in., at a speed of 106 drops per minute." Under these conditions the new mill consumes:

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the theoretical horse-power.

By dynamometer measurements Von Reytt obtained a ratio of theoretical horse-power used in overcoming gravity to actual power used in overcoming gravity, plus friction, of 1 : 1.127. Henry Louis computed this value theoretically at 1 : 1.202. Taking Von Reytt's figure, the actual horse-power to operate the 20 stamps run under the most perfect conditions would consume 42¼ hp. The 12 Frue vanners, line-shafting, and concentrator counter-shafting would easily consume 10 hp. more, so that the 50-hp. motor very likely is working with a slight overload.

I would be interested to know in what details the new mill varies from the old one, so as to account for the great improvement in the work as described.

San Francisco, January 25. H. HAAS.

GOLD MINING IN COLOMBIA.

Written for the Mining and Scientific Press
By F. Lynwood Garrison.

The valleys of the Cauca river and its tributaries are the most important part of the Magdalena river system, which constitutes a network of streams comparable in its lower reaches to the Mississippi, but inferior to our great North American river in volume and length. From its source near Popayán in the great mountains of the Central Cordillera to the town of Cáceres, a distance of about 350 miles, the Cauca river is essentially a large rapid mountain stream. Below Cáceres the valley widens rapidly, the current slackens, and the alluvial gravels gradually disappear as the mountains that parallel its banks sink into the great silt plain built up by the Magdalena river. Both the Cauca and the Magdalena carry an enormous amount of silt, in fact, with the exception of the Colorado river, I have never seen anything to exceed it. Rising in the vicinity of the Purace volcano (16,000 ft. high), the upper course of the Cauca river drains a large area of volcanic rocks, and its waters are said to be so acid that no fish can live in them for many miles from its source. This has given rise to its local name of Rio Vinagre. Some distance below the ancient town of Popayán the river enters a broad valley and becomes a quiet but turbid navigable stream. Soon after passing Cali the western mountains crowd down to the river, and just north of the town of Cartago the valley closes in and the river begins a series of rapids that become more violent as it plunges into gorges so steep and rugged that it is said no footpath can traverse them. For 60 miles above the town of Antioquia there is a stretch of slack-water which is navigable, and then the rapids re-commence and render the river impassable for steamers, at least as far as Valdivia and usually to Cáceres. These gorges and rapids consequently divide the river into two navigable portions which have no commercial relation with each other, the lower one being vastly the more favored, as it has direct and easy communication with the seaboard by the navigable waters of the Cauca river itself and the Magdalena. The upper Cauca river, however, is completely shut off except by way of the railroad connection from Cali to Buenaventura harbor, on the Pacific coast.

Before proceeding further it would seem proper to discuss the geological conditions of this exceedingly interesting part of the world. In order to do this it will be necessary to build up our sketch in a synthetic manner from the fragmentary and not always reliable statements of the few geologists or pseudo-geologists who have visited the country. The most southerly mountains of Colombia are a confused mass which extends into Ecuador and includes the great volcanoes Sangay and Cotopaxi. None of the volcanoes in Colombia are of great elevation, but several are from 14,000 to 16,000 ft. high. The three ranges which spring from this central cluster of mountains are known in Colombia as the Western, Central, and Eastern Cordilleras. As the Cauca valley and its tributaries, the Nechi and Porce, lie between the Western and Central Cordillera, we need not concern ourselves at present with the Eastern. The axis of the Western Cordillera appears to be chiefly composed of eruptive rocks having an andesitic or porphyritic character. This backbone is flanked on both sides by metamorphic rocks of a distinctly pre-Cambrian type. Upon the gneisses, granites, and schists of this formation are sedimentary rocks of the Triassic or Jurassic, and possibly in the district we now are considering, some Cretaceous. The Central Cordillera begins at the Ecuador frontier with a group or range of recent volcanoes, including Huila, 18,000 ft.; Tolima, 18,400; Ruiz, 17,400; Santa Isabel, 16,700, and the Mesa de Herveo, 18,300, the last being the remains of a still greater cone, the top of which was probably blown off, leaving a vast crater with a level outline, giving at a distance the appearance of a flat table-land. The summits of Ruiz, Herveo, and Santa Isabel are collectively known as the Páramo de Ruiz. As the central range progresses northward into Antioquia, it gains in breadth and loses in height, the volcanic rocks being replaced by metamorphic formations of pre-Cambrian character, similar to those of the Western Cordillera. J. C. F. Randolph* states that evidence is not lacking that in many points of the Central Cordillera the eruptive rocks have broken through the schists and form the backbone of the range. The schists coincide in strike with that of the range, and dip east. This formation in turn is overlaid by Triassic sandstone, and at places thin patches of Jurassic limestone containing characteristic fossils; the Triassic sedimentaries have been much broken and distorted, probably at the time of the upheaval of the Central Cordillera, and are frequently seamed with dikes of andesitic and other magmatic rocks. Randolph considers that these upheavals took place either at the end of the Triassic or the beginning of the Jurassic, and that subsequent erosion in Quater-



Map of Colombia.

*Trans. A. I. M. E., vol. XVIII, page 209.

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Written for the MINING AND SCIENTIFIC PRESS
By F. LYNWOOD GARRISON.

The valleys of the Cauca river and its tributaries are the most important part of the Magdalena river system, which constitutes a network of streams comparable in its lower reaches to the Mississippi, but inferior to our great North American river in volume and length. From its source near Popayán in the great mountains of the Central Cordillera to the town of Cáceres, a distance of about 350 miles, the Cauca river is essentially a large rapid mountain stream. Below Cáceres the valley widens rapidly, the current slackens, and the alluvial gravels gradually disappear as the mountains that parallel its banks sink into the great silt plain built up by the Magdalena river. Both the Cauca and the Magdalena carry an enormous amount of silt, in fact, with the exception of the Colorado river, I have never seen anything to exceed it. Rising in the vicinity of the Purace volcano (16,000 ft. high), the upper course of the Cauca river drains a large area of volcanic rocks, and its waters are said to be so acid that no fish can live in them for many miles from its source. This has given rise to its local name of Rio Vinagre. Some distance below the ancient town of Popayán the river enters a broad valley and becomes a quiet but turbid navigable stream. Soon after passing Cali the western mountains crowd down to the river, and just north of the town of Cartago the valley closes in and the river begins a series of rapids that become more violent as it plunges into gorges so steep and rugged that it is said no footpath can traverse them. For 60 miles above the town of Antioquia there is a stretch of slack-water which is navigable, and then the rapids re-commence and render the river impassable for steamers, at least as far as Valdivia and usually to Cáceres. These gorges and rapids consequently divide the river into two navigable portions which have no commercial relation with each other, the lower one being vastly the more favored, as it has direct and easy communication with the seaboard by the navigable waters of the Cauca river itself and the Magdalena. The upper Cauca river, however, is completely shut off except by way of the railroad connection from Cali to Buenaventura harbor, on the Pacific coast.

Before proceeding further it would seem proper to discuss the geological conditions of this exceedingly interesting part of the world. In order to do this it will be necessary to build up our sketch in a synthetic manner from the fragmentary and not always reliable statements of the few geologists or pseudo-geologists who have visited the country. The most southerly mountains of Colombia are a confused mass which extends into Ecuador and includes the great volcanoes Sangay and Cotopaxi. None of the volcanoes in Colombia are of great elevation, but several are from 14,000 to 16,000 ft. high. The three ranges which spring from this central cluster of mountains are known in Colombia as the Western, Central, and Eastern Cordilleras. As the Cauca valley and its tributaries, the Nechi and Porce, lie between the Western and Central Cordillera, we need not concern ourselves at present with the Eastern. The axis of the Western Cordillera appears to be chiefly composed of eruptive rocks having an andesitic or porphyritic character. This backbone is flanked on both sides by metamorphic rocks of a distinctly pre-Cambrian type. Upon the gneisses, granites, and schists of this formation are sedimentary rocks of the Triassic or Jurassic, and possibly in the district we now are considering, some Cretaceous. The Central Cordillera begins at the Ecuador frontier with a group or range of recent volcanoes, including Huila, 18,000 ft.; Tolima, 18,400; Ruiz, 17,400; Santa Isabel, 16,700, and the Mesa de Herveo, 18,300, the last being the remains of a still greater cone, the top of which was probably blown off, leaving a vast crater with a level outline, giving at a distance the appearance of a flat table-land. The summits of Ruiz, Herveo, and Santa Isabel are collectively known as the Páramo de Ruiz. As the central range progresses northward into Antioquia, it gains in breadth and loses in height, the volcanic rocks being replaced by metamorphic formations of pre-Cambrian character, similar to those of the Western Cordillera. J. C. F. Randolph* states that evidence is not lacking that in many points of the Central Cordillera the eruptive rocks have broken through the schists and form the backbone of the range. The schists coincide in strike with that of the range, and dip east. This formation in turn is overlaid by Triassic sandstone, and at places thin patches of Jurassic limestone containing characteristic fossils; the Triassic sedimentaries have been much broken and distorted, probably at the time of the upheaval of the Central Cordillera, and are frequently seamed with dikes of andesitic and other magmatic rocks. Randolph considers that these upheavals took place either at the end of the Triassic or the beginning of the Jurassic, and that subsequent erosion in Quater-



Map of Colombia.

*Trans. A. I. M. E., vol. XVIII, page 209.

nary time produced the gold-bearing alluvials. This competent observer refers more particularly to the district of Tolima, with which he was personally familiar, but he states that, according to the consensus of opinion of other observers, similar conditions are found north in the State of Antioquia, as well as in the Western Cordillera. Judging from my own limited observations in Antioquia, I believe these deductions are correct. I found what Randolph calls Archean rocks, but what I would prefer to consider pre-Cambrian, abundantly exposed in the Cauca valley, especially in the section between Cáceres on the north and Valdivia on the south. The greatest elevation I personally obtained above the Cauca valley was about 2500 ft., at Raudál, in the Central Cordillera. The mountain tops at this place have been cleared for several hundred acres, to afford grazing, hence it was comparatively easy to make observations upon the underlying rocks, and I found everywhere nothing but these metamorphic schists and gneisses, seamed and laced by innumerable quartz veins carrying a small quantity of gold. Some of these veins are from 20 to 25 ft. thick, and may be traced for miles. I had been told that they were quite rich at places, but my own sampling did not confirm this statement. I found them lean, as is usually the case with massive dull white quartz veins. I noted a few instances of dikes cutting the schists, but as a rule they were small, and apparently not numerous. It must be remembered, however, that the difficulties in making geological observations on mountain sides clothed with tropical jungle are tremendous. The district of which I speak is extremely wild; there are no roads, few trails, and in the rainy season these are horrible beyond description; moreover, there are few inhabitants. I know of nothing more exhausting than climbing up and down these jungle-clad mountains in the wet season. The moisture-laden air admits of little or no evaporation from the skin, and throws a strain upon heart and lungs not to be long endured with impunity by most men. These difficulties, of course, lessen with the elevation, but it was not my luck to be much in higher altitudes above the moisture-laden atmosphere of the river valleys. Randolph, in referring to the quartz veins in the schists of Tolima, says, "These veins have a general tendency to wedge out and reappear in sympathy with the mobile curves of the schists. No vein cutting the formation has yet been found in Tolima. As a rule these veins in the schists are thin and of little value."* It might be remarked in this connection that generally throughout South America, the coast Cordillera (which in Colombia splits up into the Western and Central ranges) is formed to a considerable extent of rocks having an Archean aspect, such as gneisses, mica schists, etc., associated with old eruptive rocks, and deposits of sandstones and shales, usually devoid of fossils. According to Suess† it is by no means certain that these rocks are actually Archean. Darwin appears to have entertained similar doubts.

*Ibid, page 211.

†'Face of the Earth', Vol. I, page 538.

The problem seems now by no means nearer solution than 75 years ago, and probably cannot be cleared up until South American, or more particularly Andean, geology has been more thoroughly and carefully studied. Personally I prefer to class these rocks as pre-Cambrian, although it seems one can never be sure as to what particular age metamorphic rocks may belong. I have seen metamorphosed sedimentary rocks so like metamorphic eruptives that it was almost impossible at first sight to distinguish between them, yet one was certainly Archean and the other Tertiary. I can never feel sure when I call a rock Archean that it is not something else. In view of the important relation that this class of rocks bears to some of the greatest gold deposits in the world, especially the alluvials, its proper determination is a matter of much more than mere scientific interest.

The Cauca valley, at least that portion between Valdivia and Cáceres, is probably a synclinal trough, the Western Cordillera forming one and the Central the other side or arch. The Western range is much the higher of the two, and it is probable that the eruptive rocks of its core break through at the summit or crown, leaving the metamorphic rocks on the flanks. These metamorphic schists and gneisses constitute the foothills that extend from the Cauca river to the main range, and it is probable that in the innumerable gold-bearing quartz veins, which in places constitute a considerable proportion of their bulk, is to be found the source of much of the gold in the alluvials. In the section between Valdivia and Cáceres the Central Cordillera is much lower than the Western, and seemingly the eruptive or magmatic rocks have not broken through the apex of the range. The rocks of the Central range are apparently similar in this respect, and have doubtless contributed a large quota of gold to the river gravels, but this proportion is probably less than that derived from the Western range, as there are fewer small tributary streams or feeders flowing down from the mountains on the eastern side of the river.

The bulk of the gravels in the bed of the Cauca river appear to be composed of porphyritic and andesitic rocks; granite and gneiss are common, but as might be expected from their softer nature, schists are rather rare. We may infer from this that most of the pebbles and boulders come from the Western range, and that the proportion of metamorphic rock in the river gravels is small, except near the mouths of the large tributary streams. This fact is of practical importance, since the gravels where un-enriched by the wash of the side streams, are probably too lean to pay to dredge, whereas at the mouths of these large streams, such as the Taraza, and at some distance below the point of confluence, the gravels show evidences of richness. The amount of erosion necessary to have produced the gravels of the Cauca river valley must have been enormous, as our drill-holes showed a thickness of more than 40 ft. in the very bed of the river; and the benches or *cerros* on the banks often rise straight up 60 to 75 ft. above bedrock. This condition is well illustrated at the Icobo

hydraulic property about 10 miles below Valdivia. None of the gravels that we saw in the district were cemented, and below the Angostura gorge, that is, near Cáceres, there are no evidences of large boulders. The gravels composing the old Quaternary benches back from the rivers are often much decomposed, containing some clay, but judging from our observations, there is usually not enough present to seriously interfere with hydraulic or dredging operations; at least I saw no distinct beds or layers of clay intermixed with the gravel. Wherever there are decomposing feldspathic rocks the presence of some clay is inevitable, but in this case it does not appear to be segregated or disseminated in sufficient quantity to cause much trouble.

A notable characteristic of the gravels in the Cauca river bed is the presence in them of large amounts of pyrite, especially in the eruptive rocks. A condi-



Testing Gravel With Empire Drill.

tion similar to this has been noted by Levat, in the diorite gold-bearing gravels of French Guiana.* In this instance as much as 5.2% FeS_2 was found in some of the diorite, which on assaying showed from 15c. to $1.24 gold per ton. It might be observed in this connection that in Guiana the decomposition of these diorites has given rise to accumulations of clay in the gravel, causing a serious drawback to their successful treatment for recovery of the gold, moreover, these deposits as a rule are said to be shallow, and situated in unhealthy districts. On the contrary, the Cauca river gravels are almost always thick, uncemented, and contain relatively little clay. In French Guiana, as in Colombia, the source of the gold appears to be chiefly in the numerous quartz veins intercalated with the crystalline schists of the metamorphic rocks. Levat observes† that these quartz veins are usually lean, except in the vicinity of the accompanying dioritic rocks. Just what proportion of the gold in alluvials is derived from the eruptive rocks is impossible to conjecture. It seems probable, however, that most of it comes from the veins in the schists, for they often possess visible gold, whereas it is uncommon in the eruptives. The gold in the



Street in Candeva.

gravels of the Cauca river bed does not differ much in appearance and purity at various places in the district under consideration, but in the benches along the sides of the river are quite appreciable variations, in fact the storekeepers of the little mining towns of



Hydraulic Mining in Icobo.

Cáceres and Candeva claim, and I think with truth, that they can detect with a glance from what particular locality or property any lot of gold dust has been obtained. These variations are chiefly due to the color, the purer the gold, the deeper its yellow

Annales des Mines, 9th series, Vol. XIII, 1898, page 443.
†Ibid, page 446.

appearance; then again, some of the gold is rusty, or coated with oxide of iron, and indicates that it came from old bench gravels in which much rock-decomposition has taken place, the leaching, oxidizing action being responsible for the deposition of ferric oxide on the particles of gold. Similar facts are of course familiar to most placer miners, but it seems proper to call attention to the matter in this connection, as in this way we may be able to account, in some measure at least, for the so-called rustiness or reddish color of the gold and the apparently unexplainable difficulties often encountered in amalgamating. The gold derived from the decomposition of pyrite in the eruptive rocks must usually be set free in an exceedingly finely divided condition, and the question arises, does it in this form contribute any increment to the recoverable gold in the gravel. In other words, is it possible owing to its extremely minute condition, to save some of it along with the coarser particles? It seems probable that little, if any, of this gold can be saved, unless it be dissolved by the river water and re-precipitated upon the larger gold particles in the gravel. The solubility of gold and its re-precipitation from solution in alluvials is a question upon which there is much difference of opinion; it cannot be discussed in this article, and may be dismissed with the query, how does gold become purer and purer as it travels away from its source, unless the silver it originally contained is removed by solution? There can be no doubt as to this fact, for it has been noted over and over again in different parts of the world, but how this natural refining operation takes place is not so clear.

The quantity of gold in the Cauca river alluvials is, as in other similar deposits throughout the world, exceedingly variable. The rich streaks of the bench gravels along the river side will often run as high as $1 per cubic yard; close to the water's edge where eddies have deposited much river wash, small areas are sometimes found of extraordinary richness—$4 or $5 per cubic yard. Seldom does one fail to find at least some small particles or 'colors' of gold in a batea (pan) full of gravel. The existence of the gold in the gravel is almost universal, but of course erratic in quantity if not in quality.

The metamorphic series of rocks are overlaid by sedimentary deposits, said to be Triassic or Jurassic in the States of Tolima and Cauca, and probably Cretaceous in Antioquia. It seems likely that the identification of these formations has been in the main correct as far as Tolima and the southwestern portion of Colombia are concerned, but whether the sedimentaries of the Cauca valley in Antioquia are Triassic or Cretaceous, it is impossible at present to say, because no fossils have yet been found in them, nor indeed, as far as I know, have these rocks been studied by any competent geologist. Between Valdivia and the Angostura gorge the sedimentaries appear in only a few spots, increasing in frequency northward. They are well exposed above the falls of the Puqui creek, a short distance north of the town of Candeva, and they can also be seen in small quantity at the hydraulic workings of Icobo on the west bank of the Cauca. The Angostura gorge appears to be entirely of metamorphic rocks, which outcrop as far down the river as the Apavi ranch; below this point the rocks along the line of the river are all sedimentary, consisting of sandstones, grits, clays, and fine pebble conglomerates.

At several places in the vicinity of the town of Cáceres, notably on the Taraza river at a place called Cacagual, coal seams are found in the sedimentary rocks, which at this place outcrop along the side of the river. The seams here dip north 10° east, the upper one of the series being about 8 in. thick. There are several lower veins, ranging from 18 to 30 in., and finally a large seam, the thickness of which I could not accurately determine, but it is probably 4 or 5 ft. This seam comes to the surface back in the jungle, and is not shown in the illustration. It is evident, from even this cursory examination, that the coal deposits cover a large area and include some workable seams sufficiently accessible to be of commercial importance. The character of the coal is unusual; it is compact, glossy, and does not soil the fingers, resembling cannel coal. When powdered, the coal shows no brownish tint, and it possesses a distinctly laminated structure. When held in the hand it can be lighted from a match and burns with a glow like punk, but not with the long flame of cannel coal. The following analyses show the composition of the coal found on the Taraza river:

	I. Per cent.	II. Per cent.
Moisture	13.60	15.36
Volatile carbon	38.10	47.41
Fixed carbon	44.40	32.67
Ash	3.80	4.56
Sulphur	....	0.547

It is evident from this analysis that it is a highly gaseous coal of unusual purity, containing a large amount of moisture. I am disposed to think that coals from moist tropical countries may be peculiar in this respect, although a high proportion of moisture is certainly not unusual in North American coals.

The area of workable coal deposits in Colombia is apparently large, but as yet there are practically no coal mining enterprises in the country. Large deposits are reported at Cali, on the upper Cauca river, some 200 miles north of Cáceres. In the State of Cundinamarca, near the capital city, Bogotá, are some large deposits, and in the Sierra Nevada mountain complex on the Rancheria river near Rio Hache on the Caribbean coast are other extensive coal deposits. Many years ago the famous Dr. John Percy, of the Royal School of Mines in London, analyzed a lot of coals from Colombia, and published the results in his book on fuel, with the following notes:

	I. Per cent.	II. Per cent.
Carbon	76.45 — 81.86	56.66 — 72.65
Hydrogen	4.88 — 5.22	4.08 — 5.23
Oxygen and nitrogen	12.06 — 12.92	17.25 — 22.12
Sulphur	0.25 —	0.30 — ....
Ash	1.25 —	2.63 — ....
Water	5.11 —	19.08 — ....

"No. I is a non-coking coal, rich in oxygen. It is black, compact, firm, but not bright and scarcely soils the fingers, no trace of iron pyrites can be seen

in it with the naked eye; it produces a long flame and may be regarded as a valuable fuel for raising steam, smelting in reverberatory furnaces, etc. It yields a slightly coherent coke. Color of the ash, pale gray with pinkish tinge. Calorific power in Thompson's calorimeter, 13.75."

"No. II is evidently lignite, properly so called, as far as composition is concerned. It is black, and so tender as to be incapable of transport or storage without crumbling. Thompson's calorimeter gave 9.90."*

These coals, I believe, came from the Rio Hache district, or else from some beds near the gulf of Uraba (Darién). The coal of the Cáceres district is certainly not lignite, and possesses the unique distinction of being overlaid by thick rich beds of



Gold-Gravel Overlying Coal-Beds.

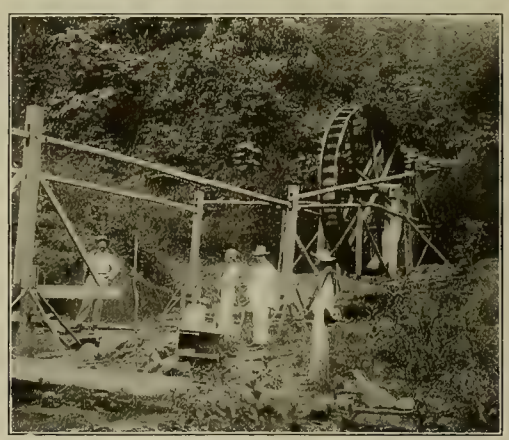
auriferous gravels, hence a dredge or steam shovel operating in this district might get its fuel and gold from the same tract of ground.

Colombia is the least known, and the least developed, of the South American republics, yet of all of them it is the most accessible from the United States, and by virtue of the great Magdalena river and its navigable tributaries it has a channel of entry, and opportunities for cheap transportation to hundreds of miles of its interior, not possessed by any of the Pacific coast republics of South America, Central America, or even Mexico. There is the best evidence that the mineral resources of Colombia are great, especially as to gold and coal. Unstable government, and the rugged topography of its southern districts, have been great obstacles to its progress and development. The climate of the Magdalena delta is unhealthy, but the upper river and the Cauca valley are salubrious although hot, while every variety of climate, from temperate to frigid, may be found in the mountain districts of the south and the high plateau of Bogotá. Judging from what I personally saw of this great country—and it was very



Gold 'Colors' in Batea.

little—I firmly believe its undeveloped resources are extraordinary. Possibly I have seen only a favored spot, as the lower Cauca valley undoubtedly is, but while this may be true, it seems likely that there are



Native Pump, Valdivia.

other places with equal or superior advantages, although as regards transportation to a mountainous mining district, this would hardly be possible, for there already exists direct steamboat communication between the coast and the town of Cáceres, in the heart of the district under discussion. It is not safe for one, even though he be an experienced traveler like myself, to spend but a few months in a foreign country, and then draw definite and comprehensive conclusions regarding it; yet by conversation and close study it is sometimes possible to obtain fairly accu-

*Percy's 'Fuel,' page 339.

rate ideas of even so large and sparsely inhabited a country as Colombia, its people, and, as far as known, its resources. Hence, when I venture the prediction that within the next decade we will hear of Colombia, the Panama Canal, and the real Eldorado, bracketed in one and the same thought, I may perhaps not be going too far.

A number of mining schemes and enterprises have been exploited in Colombia, many of which have been dismal failures; dredging contraptions that could not possibly work or pay in California have been thought good enough for Colombia; men absolutely without experience in any kind of mining have been placed in charge of operations in this country, a place where honesty, prudence, experience, and a resourceful character are prime requisites in a successful manager. Business men otherwise sane put their money into these crazy schemes, and expect miracles to happen, and when inevitable and deserved failure results they condemn the country, its people, climate, and government, and end by saying, "it's too far away from home," which a glance at the map shows to be absurd, for the town of Cáceres, far in the interior of Colombia, is about the same distance from New York as is Salt Lake City. One or even a dozen swallows do not make a summer, and the score or more of crazy mining enterprises that have failed in Colombia should not condemn this great, rich country, or prevent its development by Americans with brains and money.

No better substantiation of my good opinion of Colombia as a future gold-mining country could be adduced than the statistics of its gold production since the Spanish conquest. These estimates are based chiefly on the researches of Vicente Restrepo, a painstaking Colombian gentleman, who published in 1886 a book entitled, 'A Study of the Gold and Silver Mines of Colombia'. The English translation of this work was published by C. W. Fisher in New York in 1886. I have not been able to obtain the English version, so I quote from the last edition of the original Spanish.* According to this authority the total production of gold and silver up to 1886 was $672,000,000, of which $639,000,000 was gold and $33,000,000 silver. Since 1886 the total annual gold production of Colombia may be estimated at about $2,500,000, at which rate the total yield down to the end of 1908 would be $694,000,000 in gold alone. Of this great total it is estimated that a little over one-half was produced by the Department of Antioquia, and nearly as much by the State of Cauca, the proportion, of course, being the same for each annual yield. Restrepo distributes the total gold production during the historical period as follows:

	Gold.	Silver.
16th Century	$ 53,000,000	$ 6,500,000
17th Century	173,000,000	9,000,000
18th Century	205,000,000	1,500,000
19th Century (to 1886)	208,000,000	16,000,000
	639,000,000	33,000,000

Estimates by different authorities of the total gold production in Colombia show considerable difference. De Launay* places it, down to 1902, at $910,000,000. Granger believes it to have been about $1,000,000,000.† Other writers have placed it at about $750,000,000.‡ Personally I am disposed to take Restrepo's figures as the most reliable, at any rate it is likely the gold production of Colombia has exceeded that of any other South American country, including Brazil.

It is of interest at this point to compare these figures with the total yield of the chief gold producing countries of the world. The production of California since 1848 has been $1,400,000,000; of Australia, from the year 1851, including Victoria ($1,300,000,000) and West Australia ($280,000,000) is $2,710,000,000. Russia and Siberia have produced $1,300,000,000, South Africa about $1,000,000,000, and some authorities put the yield of Brazil at $780,000,000, but this is probably excessive. Of late years the production of California, Australia, and Russia show a steady decline, while that of Alaska and South Africa display a great increase. When we consider that few mines in Colombia are provided with modern equipment and that nearly all of this vast yield of gold has been produced from alluvials by hand-washing with the wooden batea, the result is remarkable. One may therefore be pardoned the extravagant statement that modern mining appliances and equipment, backed by energy, brains, and money, would make Colombia the greatest gold-producing country the world has ever seen. The amount of gold that has been won by the primitive batea must surely be little as compared to what it is possible to produce by modern methods. While there are evidences of old workings almost everywhere in the Valdivia-Cáceres portion of the Cauca velley, the amount of gravel worked is certainly insignificant as compared with the vast area of alluvial deposits to be found there. Moreover, the old workers operated only the rich spots, as do the natives now. The tendency of modern gold mining is to greater and greater economy, and an enormous increase in the amount of material handled. This is especially true in dredging, and we certainly have not yet realized the limits of improvement possible in mechanical and chemical methods of gold recovery. If the business activities of the world are to increase in the same proportion as in the past decade, we must have more and more gold to meet the demands of trade and the consumption in the arts. In the face of a declining production from the older gold mining countries, new fields must be found. In a modern sense, Colombia cannot be considered an old gold prducing country, though strictly speaking it is one of the oldest. By that I mean, modern appliances have so changed the aspect of the industry that Colombia is not in the same class as a gold producer with California, Australia, and Alaska. Some ill-informed economists (not mining engineers) gravely tell us that the great improvements in modern mining methods of gold re-

*'Estudio Sobre las Minas de Oro y Plata, de Colombia.' Bogotá (Segunda Edicion), 1888, pages 149-159.

*'The World's Gold.' Putnam Sons, N. Y., 1908, page 119.
†*Engineering and Mining Journal*, Aug. 4, 1906, page 194.
‡Ibid, May 30, 1908, page 1096.

covery will not only maintain our present gold production in the old districts, but may cause a steady increase. Anyone who has carefully considered the matter and is familiar with gold mining and milling will not believe this, and statistics bear out the assertion. The great bulk of the world's gold production comes from alluvial deposits, and when they are exhausted, and not until then, may we begin to worry. The unique deposits of the Rand in South Africa are in fact alluvials metamorphosed or at least silicified and solidified into beds and seams, commonly but incorrectly called reefs, and subsequent to this hardening they were tilted or inclined at a high angle to the horizontal by deformation of the strata. It is therefore evident that these great and profitable deposits in South Africa belong in the category of alluvials.

ELECTRIC STEEL REFINING.

In the field of steel refining electrometallurgy is now making most striking and most important advances. This has not been an evolution of the steel industry from within, but an invasion of the field from without. Not only were the pioneers of this development electrochemical engineers rather than practical steel men, but in view of the skeptical and reluctant attitude of the existing industrial steel plants, these pioneers were forced to erect their own electrical steel works independent of the existing industry. Thus Héroult installed his own steel plant in connection with his aluminum and ferro-alloy works, Kjellin had his own induction furnace steel plant in Sweden, Stassano erected large works of his own in Turin, and now Girod is building a special steel plant of a size which should surprise any doubting Thomases. There are now in operation or in course of erection 19 Héroult furnaces of an aggregate charge capacity of 63,300 kg., and 5 Héroult furnaces the capacity of which has not yet been definitely decided; 11 Stassano furnaces of an aggregate capacity of 16,900 kg.; 8 Girod furnaces with a capacity of 34,000 kg.; 10 Kjellin induction furnaces with a capacity of 21,500 kg.; and 10 Roechling-Rodenhauser modified induction furnaces with a capacity of 29,200 kg. The above figures include 2 Héroult furnaces in this country, the other 22 being abroad. The furnaces of the other types are all in Europe. There are, however, some small Colby induction furnaces in operation in this country; one, chiefly for demonstrating purposes, at Niagara Falls.

There is evidence now of a change of attitude by the existing steel companies of this country toward the electric furnace. One of the most interesting signs of the time is the testimony given by Charles M. Schwab before the Ways and Means Committee in the tariff hearings, who said: "We have taken another step in advance, which has been developed by the Germans, and that is the electric method of producing steel, which is an advance again over the open-hearth, that I am certain in the next ten years, or probably quicker, depending upon the rapidity of the development, will probably make all open hearths practically useless. These processes have not been for the purpose of cheapening the product, but of bettering the quality."

The electric steel furnace will not displace the open-hearth or the Bessemer converter. It is considerably cheaper to make steel in two steps in the open-hearth (or in the converter) and refine it in the electric furnace, than to make it in the electric furnace alone in one step. Dr. Héroult's method of operation is to extend the open-hearth process to the point where the steel is dephosphorized to the desired degree; it may then be highly oxidized, but this does not matter, as the steel is to be treated now in the electric furnace. There the steel is de-oxidized (which is possible on account of the reducing atmosphere of the furnace), the sulphur is reduced, and the steel is re-carbonized to the desired degree. The desulphurization accompanies the de-oxidation, and the remarkable success of desulphurization is due to the formation of calcium sulphide, which is a specific electric-furnace re-action. In this way it is possible to get a final steel product in which the sulphur and phosphorus are reduced to any desired degree. An important advantage of the product is its great uniformity and homogeneity, and its freedom from oxides, gases, and slag. This fact will make electric refining highly desirable, even in cases where steel is made from low-phosphorus and low-sulphur pig in the open-hearth.—*Electrochemical and Metallurgical Industry.*

Graphite, molybdenite, ilmenite, and hematite are four minerals that, because of their habit of crystallizing in dark shiny flakes, are sometimes mistaken in the field one for another. The first two, by their extreme softness, both soiling the fingers when in sufficient amount, can be immediately distinguished from the latter. Without chemical tests graphite can be told from molybdenite only by its slightly different color and, when of possible determination, by its comparative lightness. Graphite is distinctly iron-gray in color; molybdenite is lead-gray, with a distinctive bluish tinge. Chemically, graphite being pure carbon, the molybdenite, the sulphide of molybdenum, a simple test for sulphur, in the open tube or on charcoal, serves at once as a basis for identification. When ilmenite and hematite in scales cannot be told apart, as in some metamorphic rocks, a chemical test for titanium must be made. The presence of this element indicates the former mineral. This test is made by fusing the powdered substance with soda, dissolving in hydrochloric acid, and boiling with granulated tin. If titanium in more than traces be present, a delicate violet color will be produced.

Beginning with January 1, 1909, the postage on letters to Germany was reduced to 2 cents per ounce, the same as the domestic rate and also the same as the present rate to Great Britain, Canada, and Mexico. The rate, however, only applies when the letters are dispatched by steamers sailing direct from an American to a German port. If they go by way of Great Britain or France, the postage will be charged at the regular postal union rate of 5 cents for the first ounce and 3 cents for each additional ounce.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Stamp-mill dies should be harder and more elastic than the shoes. Resiliency in the die is of as much importance as is the absence of it in the shoe, in order to give high efficiency.

Iridosmine, which is generally associated with platinum, is in fair demand. The price rules slightly lower than platinum, being at the present time about $18 per ounce, less a refining charge of $2.

Gold amalgam is soluble in KCy solution. In some experiments made in South Africa, I. Roskelley showed that 111.6 grains of amalgam were reduced to 99.2 grains in 12 days by exposure to a 3% solution of potassium cyanide.

Rolls are overworked when crushing from the average maximum of ore fed to less than one third that average size. Greater economy results from working rolls at proper capacity. Locomotive-tire steel is the best material for roll-shells.

Automatic tailing-samplers usually traverse the stream, taking a split from one side to the other, and back again. This gives fairly accurate results. A better principle, however, is to take the entire stream for some small unit of time. This gives a larger initial sample, which requires to be re-sampled by the same system.

Stamp stems break at the nodal point in the vibratory wave set up within the stem by the jar. The greatest stress is not at the point of greatest amplitude of vibration, but at the nodes, which are just above the boss-head and just below the tappet. The crystallization of the steel in stems by reason of vibration is generally assumed, but has never been conclusively proved.

Manta is a Spanish word which, as used in connection with mining, means a horizontal vein similar to the type colloquially termed a 'blanket deposit'. Many miners in Spanish countries distinguish between veins dipping between 15 and 45°, called *vetas de manta,* and those from 15° to horizontal, called *vetas de sombra.* The term is also applied in Central America to auriferous detritus covering hillsides, and to deposits resulting from enrichment on the surface of a decomposing vein, such as have been termed 'saprolites' in the South Atlantic States.

Relative costs of city coal gas and producer-gas, as fuel for generating steam and for use in melting furnaces, depend on many factors. Where the source of gas is exclusively coal, the question reduces to the magnitude of consumption for steam-generation and for metallurgical purposes. For small units undoubtedly contracts could be made with established gas companies at prices less than the cost of production by individual gas plants. Large consumers would, of course, find producer-gas far cheaper than retort-gas; moreover, for power-generation the producer-gas can be used direct in gas-engines, eliminating the boiler-plant entirely.

Silicates are classified on the basis of the ratio between the oxygen in the base and acid of which they are composed. The simplest types of silicates accordingly fall within the classifications of sub, mono, bi, tri, and sesqui-silicates, having corresponding ratios of oxygen in base to oxygen in acid of 2 to 1, 1 to 1, 1 to 2, 1 to 3, and 2 to 3. For example, a tri-silicate has the general formula $R_2Si_3O_8$, which corresponds to $2RO \cdot 3SiO_2$. Where the base enters the compound as a sesqui-oxide (R_2O_3) the ratio still holds good, as for example in the tri-silicate $2R_2O_3 \cdot 9SiO_2$. Singulo-silicate is another term for mono-silicate.

Protective alkali needed by a pulp in the cyanide process is determined by making up a number of samples of the ore with cyanide solution to which quantities of lime, varying from 0.1 up to 1%, have been added. These are agitated every 10 minutes, and a sample taken from each bottle every hour, filtered, and the filtrate tested for KCy. This shows approximately the proper quantity of lime to use. Following Julian & Smart, the preliminary test having shown where the saving in KCy is stopped, take 3 samples of the ore of 20 lb. each, mix with lime in proportions equal to, above, and below the indicated quantity, place in filter jars, and run on an amount of 0.2% KCy solution, one third the weight of the ore. Leach the same solution through the pulp twice, and test for KCy. The economical minimum of lime needed for protection is thus ascertained.

A mining claim was located by A, who held possession for six years without performing the annual labor required by law. After his death B located the claim. Has A's estate any right under the circumstances that would invalidate B's location? Assuming that B's location was made peaceably and that the acts of location were regularly performed, and that A's claim did not have the required amount of assessment work done on it up to the time of B's location, and also that A's heirs or legal representatives had not resumed work and were not continuing it with diligence at the time of B's location, it may be said with reasonable certainty that B's location is valid. The death of the owner of a location does not alter the status of the claim in any sense, as far as the necessity of performing assessment work is concerned, and the title to the claim which vests in A's estate has the same character, and is subject to the same conditions, as it was prior to the owner's decease. The owner's death does not obviate nor excuse the necessity for the performance of annual labor, even though his heirs may all be minors or unknown. Up to the time that B makes his location, A's location is still a valid and subsisting one. The mere failure to perform annual labor does not *ipso facto* terminate A's title and cause a forfeiture. The forfeiture takes place only where a new location comes into existence. This has the effect of terminating the title to the older location.

PROTECTION OF INVESTORS.

Herewith follows the remainder of the discussion, the first part of which was published in our last issue. It was a discussion held at the meeting (on December 19) of the Pacific Coast division of the Mining and Metallurgical Society of America.

Albert Burch.—In addition to the items covering operations in the past, a report at the end of a certain period should give as reliably as possible a forecast of the earnings of the mine for the following period, to the time of the next report forthcoming; and, furthermore, in the case of all metals, except gold, the price of the metal on which the estimate of value is made should be specifically stated in the report, so that the investor can deduce for himself how the results will be affected by variations in price.

T. A. Rickard.—May I relate an incident that has reference to what Mr. Burch has said? In 1905, I met a mining engineer, whom most of you know, at a hotel in Mexico City. He had just written a report on a copper mine in Michoacan. He showed me this report and asked me what I thought of it. I found that his estimate of the future profits was based on copper at 13 cents. I said to him: "Why do you do that?" "Well," he said, "that is the average of the last five years." I replied: "That is so, but you are forecasting the next five years, and you know well enough that the expectation among those who are in touch with the copper market is that copper will be more like 17 cents than 13." He said: "Yes, but I wanted to be on the safe side." I said: "No sir, you have no right to put yourself on the safe side. You are here to give honest advice, and if you believe that the price will be 17, you have got to state it at 17, for it is just as much your duty to forecast the price on which your estimate is based as to make an estimate of the tonnage. Your estimate of the tonnage is worthless unless it is tied to an estimate of the price of the metal." He said: "We engineers are not supposed to forecast the price of the metal. All we have to do is to report what we have found."

Charles Butters.—I might make a little remark in that connection. At one time I was doing a large piece of business with the Calumet & Hecla people, relative to treating their accumulated tonnage of tailing and the future ore produced by the Calumet & Hecla mines, and I drew up a statement regarding the profits that would be made from the work. Mr. Livermore, the vice-president of the company, looked it over carefully and saw the price that I had put on copper, on which I based my profit. As the business was to extend somewhere between 25 and 30 years, he and Mr. Agassiz stated that anyone going into the copper business should always be prepared to meet the lowest price that copper had ever seen. He said: "We have seen copper twice at 9 cents"; and added: "If you cannot make a profit at 9 cents, your figures are not sound. We have seen it twice at 9 cents and we are liable to see it again."

S. B. Christy—That was for a 25-year period.

T. A. Rickard.—What did you say?

Charles Butters.—I thought the point was well taken.

S. B. Christy.—In regard to the point raised by Mr. Rickard: It seems to me that it is difficult to value a mine at a given price and then take the responsibility of its failure to do so by reason of a drop in the price of a metal. It adds a great deal to the engineer's responsibility.

T. A. Rickard.—That is what he is paid for. He is paid to advise honestly in regard to the future; he should give the same advice to his client that employs him as he would to his own brother. An engineer does wrong when he makes an estimate and divides it in two for safety.

W. H. Shockley.—Would it not make a difference whether he made a favorable report or not? If he turned down the property on the basis of the price of 13 cents and it went down, I do not see how it would be hurtful to his principals.

S. B. Christy.—It seems to me that there is nothing further to be said on the first head. We may take up the second, which Mr. Burch has ably opened: "How may mining companies be compelled to give such necessary items of information?" It appears to me that everybody who has touched on this subject so far has actually said that it is impossible to do so by State legislation. I think it would be unwise to even attempt it, unless it could be done by the United States Government.

C. W. Merrill.—I would like to ask Mr. Burch why it would be impossible for it to be so done.

Albert Burch.—The reason is: a dishonest mine management would easily find a way to evade any law that could be framed by any legislature, so as to comply with the letter of the law and yet violate the spirit of it in the matter of giving out mine reports—that is, compulsory mine reports. But a law could be so framed as to provide a penalty for the publication of deliberate falsehoods in connection with mine reports or in connection with mining stock advertisements, such as we see every day in the daily papers. A statute could be framed imposing a penalty for such falsehoods. But to prescribe a form for mine reports that would always contain the truth, I would consider would be impossible if the management were dishonest and wished to avoid that provision of the law.

S. B. Christy.—Would you think it possible to punish a management possessing information obtained in the way you have described and withholding it from the public? It could easily be proved that they had that information.

T. A. Rickard.—Would you call it a falsehood not to give the public information obtained by drilling holes in the way you described?

Albert Burch.—All they say is that the face of the drift is not in ore.

S. B. Christy.—Would not the intent to deceive be obvious?

Albert Burch.—It would not suffice to convict a man.

S. B. Christy.—Could you not prove that they withheld information that affected the value of the stock?

T. A. Rickard.—They would not state that they were putting in drill-holes.

Charles Butters.—Those drill-holes would be put in

during the night by one man when no one else was around.

M. L. Requa.—If the State cannot pass a law that will cover the situation, the Federal Government cannot, unless the mining company is engaged in interstate business. You might pass a national law that would cover the mining companies engaged in interstate commerce, such as the shipment of copper; but if you take the mines of the State of California that produce gold and ship it to the Mint or sell it in the open market here, there is no national law that you could pass that would reach those corporations.

S. B. Christy.—Could it not be done through the post-office department? For example, pass a law prohibiting the sending through the United States mails of any reports that fail to comply with specific requirements, and making it a penitentiary offense to do so. All statements circulated for the purpose of selling stock are distributed either by means of the newspapers or in dodgers that are sent around through the United States mails; such a law would reach about 90% of them.

Albert Burch.—That is true as to advertisements for the sale of stock, but it does not cover mine reports. A mine report can be made so as to be absolutely truthful and yet not tell anything about the mine.

T. A. Rickard.—Would it not be a good thing to make the mining companies incorporate under the laws of the State in which they did business?

M. L. Requa.—As far as California is concerned, you have to conform to the laws of California if you do business here.

Whitman Symmes.—Our law reads: "Every corporation formed for the purpose of mining, or conducting mining in California, whether such corporation be formed and organized under the laws of the State of California, or of any other State, Territory, or foreign country." I think that our laws do good; for instance, the Comstock companies are compelled to say, among other things, how much money they have on hand, and what they owe. I know of one case where a failure to so report was a cause of some loss. Mr. Clarence Mackay put some money into the Yellow Jacket mine, and on the strength of that some other people bought Yellow Jacket stock, not knowing that the Yellow Jacket company owed the bank in Virginia City about $40,000. If the Yellow Jacket had reported its indebtedness, as the other Comstock companies do, that investment would not have been made. As soon as those people found out the true condition of the company, they sold their stock.

Charles Butters.—That brings us back to the statement of Mr. Bradley that the reports should contain a statement of liabilities and assets; every directors' report in regard to a mine should be like the statement of any commercial business, giving a true statement of the assets and liabilities. Every English company does.

Albert Burch.—The greatest abuse is the sale of treasury stock, whereby most of the money goes to the brokers, instead of being spent in the development of the mine. Mr. Symmes' suggestion that the cash expenditures should be listed would prevent that abuse—paying 75% commissions for the sale of stock, 15% to the officers for salaries, leaving 10% for development. A man who buys that kind of stock has very little chance of ever winning.

T. A. Rickard.—Reference has been made to English companies, which are credited with practices a great deal better than American companies; this is generally imputed to the Companies' Acts, in force in England; but, as a matter of fact, such statements as are required under the Companies' Acts would give no more than a perfunctory account of the business of a mine. The reason why English companies, as a rule, give exemplary statements concerning their mining operations is because public opinion in England has been educated up to the point of demanding proper information in proper form. And the best way in which it can be done here is by members of this Society and men like them, who want to act honestly, compelling others by their example to do likewise. No law, if enacted, would be effective unless public opinion gave it momentum. The brutal fact is that many things are done, in Nevada, for instance, that are considered half humorous, whereas in England, where people are not a bit better, they would be considered robbery. In time we shall have the same ideas here; and we shall have them when we get more reports that are as complete and as honest as those of the Alaska-Treadwell, which were modeled in the office of the Exploration Company.

F. W. Bradley.—The financial statements in these reports were modeled by Mr. H. C. Perkins. Some of the forms covering ore reserves, assay-values, etc., have been added in later years.

S. B. Christy.—Mr. Rickard's last remark was that there was no hope of doing anything by legislation. I rather agree with that. If the Government had owned the mines in the first place and had made the giving of correct information a condition precedent to receiving a patent, they would have had everything in their own hands; but that is too late now.

Howard D. Smith.—It seems to me that the legal difficulties are insurmountable, when the Government is unable to get quasi-public corporations like the railroads to give satisfactory statements; they will have to depend upon public opinion or such opinion as this Society and other similar influences can exert to compel the publication of proper reports.

Whitman Symmes.—It seems to me that if the items that have been mentioned in this discussion were all put down, they would not cover more than three pages, and that they would constitute a standard form for mining reports; therefore, it seems to me if our Society had a standard form and we used our influence to get such a standard form into use, it might have a beneficial effect upon mine reports in this country.

T. A. Rickard.—That is a good idea.

W. H. Shockley.—That is a practical suggestion; that is really getting somewhere.

F. W. Bradley.—The members of this Society control the making of a great many reports, as our membership comprises mine managers, consulting engineers, superintendents, and men active in the operat-

ing end of the mining business. Surely we can thrash out some form that we can all agree to use. Such a form would not need to interfere with the particular type of report in use for each individual property, but it could be an addition to such reports, in the shape of one additional page, that would embody the information we consider essential.

T. A. Rickard.—I propose that a committee of three be appointed to prepare such a form of report, to be recommended by this branch of our Society, and that the committee consist of Mr. Bradley, Mr. Symmes, and Mr. Shockley.

(The motion was seconded by Mr. Merrill, and on being put by the chairman, was by him declared unanimously carried.)

S. B. Christy.—How often should such a report be published? If they are published so late as to be obituary reports, they are of no use to anybody except to those inside who have had the information in time to profit by it; that frequently happens, the ordinary stockholder getting the information too late to derive any benefit from it.

Charles Butters.—That would apply more or less to the shifting shareholder. An annual report, if it is well prepared, frequently fulfills all the requirements of a permanent investor.

T. A. Rickard.—What is an investor?

Charles Butters.—A holder of mining shares, a man who holds a mine himself, or who owns shares in a mine. His judgment is guided by careful annual analysis; a short analysis of the operations of a mine, from month to month, is not always as reliable as for a series of years; sometimes the monthly reports are actually misleading. If I myself were interested in a mine I think I should be able to get a better judgment of it by taking a series of two or three annual reports, and I would form my judgment of the value of that property from the comparison of such, rather than from reports for short periods. A report for a short period is liable to be misleading. Of course, if anyone is a speculator 'in and out', he wants a report on the varying value of a mine, because that varies almost from day to day; but the man who makes his living out of the dividends that he gets from mines is safer in not seeing reports too often. For myself, I would rather base my judgment on annual reports than on statements covering short periods.

C. W. Merrill.—I suppose you would add to that some sort of a prediction for future years, would you not?

Charles Butters.—Yes.

M. L. Requa.—In addition to the annual reports, unless it went into details, we might do something like the Southern Pacific and Union Pacific railways, namely, publish a short synopsis of the month's work and add to that a prediction of the possibilities for the coming month. That would simply mean a condensed memorandum. You could put it on a small card.

Charles Butters.—What gives value to annual reports almost as much as anything else is the continuity of the management.

M. L. Requa.—You could add to the value of that by giving a short monthly synopsis. A year is a long time in the life of a mine, and very material changes may take place in a short period.

T. A. Rickard.—You cannot predicate your suggestions for the regulation of this matter on a supposition that men are going to hold shares in mines for years. You must remember that a great many men are what you call 'in and out' buyers and sellers, and legitimately so.

Charles Butters.—I was expressing one view of it. As a mine owner and holder of shares, my temperament is to hold, and I simply state how I would form a judgment; I should prefer to form a judgment over long periods.

F. W. Bradley.—I think we are losing sight of the fact that there are real investors in mines. As I understand the question, it is addressed to the mine investor, rather than to the man who takes 'flyers'. There are shareholders who do hold mining shares year in and year out, and practically hold the stock to the end without trading in it at all. I agree with Mr. Butters that to such shareholders an annual report is of more value than a report made at more frequent intervals, although such shareholders frequently have issued to them weekly and monthly reports. However, the annual report is what they should be guided by, because they might be misled by all the various fluctuating conditions that are apt to occur in shorter periods.

S. B. Christy.—There is another point that might be mentioned. I believe there would be more investors of that kind if there were more reports on this model. I believe there would be more money invested by people, who, at present, are afraid to go into mining because they are unable to get information. On the other hand, there are a great many mines that do not live long enough to have an annual report.

Whitman Symmes.—In other words, people would come to the conclusion that if a mine cannot have an annual report, it is not a good thing to invest in.

C. G. Dennis.—Should there not be some form of monthly report, from which the annual report could be computed, some advance statement to the stockholders as to the condition of the mine from month to month?

F. W. Bradley.—I think that all mining companies that get out annual reports do get out weekly and monthly reports.

M. L. Requa.—Do those all go to the stockholders?

Whitman Symmes.—According to the State law, the monthly reports have to be on file in the office for the inspection of stockholders. The superintendent has to file a sworn report on the first Monday of each month, and the secretary files a sworn report on the second Monday of the month. These reports supplement the annual report. Sometimes in adding up those weekly and monthly reports, the totals are rather illusory. There are often errors in estimating the amount of labor and the quantity of supplies used in different portions of the work. At the end of the year the different accounts and the costs per unit should be figured back from the total company-expenditure for the year as found on the secretary's books. Timber and other supplies on hand should

also be more accurately determined than is done for the monthly reports. Wear and tear can then be better taken into account. I recall one striking instance that is to the point. When I became manager of the California Vigorit Powder Works, some years ago, I found the company had made out beautiful monthly reports, much underlined with red ink, showing the itemized cost of manufacturing each grade of powder, and the cost of packing it, and the sales-expenses; but when the twelve monthly reports were added up, they presented a cost which was one cent per pound out of the way, or an error of 10 per cent.

S. B. Christy.—There is such a thing as taking too much of the energy of the management in making reports. The annual reports should be filed; the next question is, should supplementary reports be filed at more frequent intervals?

F. W. Bradley.—I think that all mining companies that publish annual reports do get out weekly and monthly reports.

W. H. Shockley.—I thought that the question of reports was pretty well covered by the California law: that they must be filed every week and must be sworn to. If those reports are honestly made they give a great deal of valuable information.

Whitman Symmes.—Our law calls for sworn monthly reports. The superintendent has to state his receipts and disbursements; the number of men employed, and for what purpose, and their rate of wages; the work done in the mine, including all ore discoveries and the assay value thereof; the ore extracted, and from what part of the mine taken; the ore sent to the mill and its assay value; and the bullion received, shipped, and on hand. The secretary has to give an itemized statement of receipts and disbursements, the money on hand, and the indebtedness. All weekly reports from the superintendents have to be filed in the office, and be open to inspection. These provisions are not generally carried out, however. The companies fill in part of their blanks and do not fill in the rest, and their accounts do not always explain for what the money has been expended.

S. B. Christy.—There is one curious thing in connection with California mining: There is comparatively little fraud in connection with it; and over in Nevada, where mining is largely carried on by Californians, it is very different. What is the reason for that?

William Erb.—As near as I can analyze it, the condition is due to a combination of bell-boys, bootblacks, news-boys, book-keepers, and so forth, being thrown into a boom camp where any mining newspaper will publish their advertisements; the people are invited by the papers to buy stock, and they fall into the trap. It is a matter that must be regulated by public opinion. I have known responsible men, who would not tell a lie, to absolutely evade the issue when asked with reference to certain people, when a true statement would condemn those people for all time. I think that form of dishonesty had more to do with wrecking our boom at Goldfield than anything else. References were given and nothing was thought about it; they had a stock form of letter, and probably the Eastern end of it had replies dictated that were sent to people making inquiries, and they were handled by really reputable people with no gain to themselves, but thinking the ultimate gain lay within the country and therefore would come to them.

METAL RESOURCES OF THE PHILIPPINES.

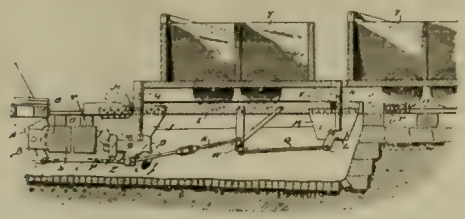
The production of gold in the Philippine Islands in 1907 was 4540 crude ounces. At the average fineness of 850, this would represent 3859 fine ounces, valued at $79,773. The production of silver is given as 83 fine ounces, valued at $55. Although gold occurs in many islands of the group, the production of 1907 is credited to but two—Luzon and Masbate. In Luzon there are two producing provinces—Benguet in the northern part, and Ambos Camarines in the southeastern part, on the Pacific coast. Masbate island, southwest of Luzon, is part of the province of Sorsogon. In a report published by the United States Geological Survey it is stated: "For centuries the Igorotes of Lepanto and Benguet have been washing gold from the streams or recovering it by impounding water in the hills and releasing it in floods over the decomposed surface of auriferous rocks, and at the same time exposing the rich and narrow veins, which they worked to slight depths. The Igorotes, and later the Spaniards, worked extensively the copper ores at Mancayan, in southern Lepanto, near the northern boundary of Benguet. The ores, which are mixed sulphides, arsenides, and antimonides, sometimes carry as much as $5 per ton in gold, particularly in the pyrite. In the Camarines, particularly at Paracale and Mambulao, European capitalists at one time did extensive underground work and erected modern mills. Their work was interrupted by the native insurrection of 1896, and has been resumed only in a small way by American miners. During the last year a dredge installed by American and New Zealand capital has made an output of gold most encouraging to the operators, and additional dredges are contemplated for this district. In the northern part of Masbate, at Aroroy, many old abandoned gold mines of the Spanish régime, or of earlier times, have been actively prospected and partly worked by the American miners. Silver ores occur rarely in the Philippines, the one notable deposit being in northern Benguet, near the Lepanto line. This is in part native silver, but the deposit has not been developed. Lead ores carrying silver occur in the islands of Cebu and Marinduque, but they have not yet been developed."

The waste in coal mining is equivalent to about one-half of the total product mined, or, for the year 1907, about 240,000,000 tons. The aggregate of mineral waste for the past year is estimated to approximate $1,000,000 per day in value. The mineral production of the United States during 1908 was approximately $2,000,000,000, so that this estimated waste is equivalent to more than one-sixth the value of the total commercial output.

MINING AND METALLURGICAL PATENTS.

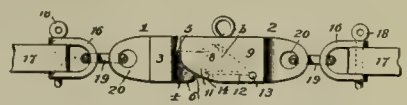
Specially reported for the MINING AND SCIENTIFIC PRESS.

MINE-CAR STOP.—No. 907,350. Charles M. Henretta, Byesville, Ohio.



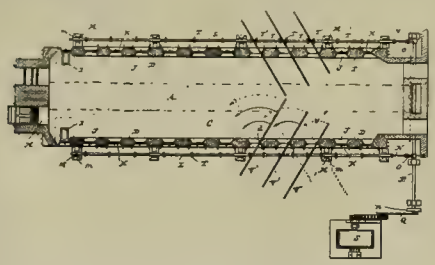
A car stop comprising a support located between the rails of the track and yieldable lengthwise, a stop block hinged to the support and arranged to swing up or down to stop or pass a car, a trigger supported under the track and normally engaging the block to stop a car, and means to release the trigger.

MINE-CAR COUPLING.—No. 908,880. Thomas C. Nation, Equality, Illinois.



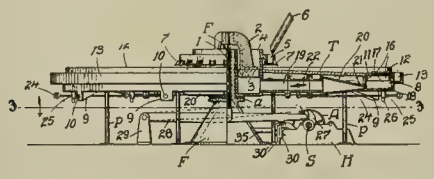
A coupling comprising two vertically swinging members adapted to be interlocked by being engaged at an angle to each other and then brought into longitudinal alinement, said members having portions to engage each other when the members are in alinement in interlocked relation and said members being so arranged that the weight of the same will tend to maintain said portions in engagement and the members in interlocked relation.

ORE-ROASTER.—No. 908,425. Cyrus Robinson, New York, New York.



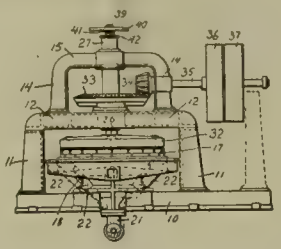
In an ore roasting mechanism, the combination with the hearth having a discharge passage at its end and a series of two or more openings in its side wall supplemental to the discharge passage adapted to have rabbling tools inserted thereinto through said openings in its side walls, of a power mechanism adjacent to the hearth and adapted to detachably engage with and impart vibrations to the rabbling tools, in arcs in substantially horizontal planes while the tools are projecting through the side walls, substantially as set forth.

APPARATUS FOR THE RECOVERY OF PRECIOUS METALS FROM SLIMES, ETC.—No. 893,472. Alphonsus J. Forget, Los Angeles, California.



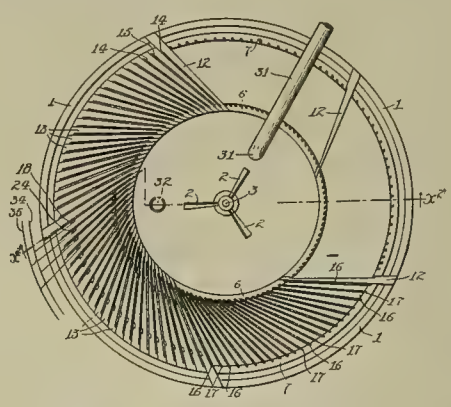
An apparatus for separating gold or other metals from their ores, comprising a tank, a rotatable circulator located centrally in the tank for causing vertical movement of the material in the tank, and electrodes in the tank extending tangentially to the vortical movement.

ORE-GRINDING MACHINE.—No. 909,286. George A. Denny, London, England.



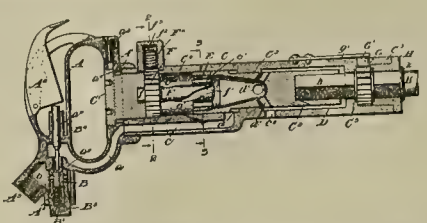
A grinding machine comprising a lower stationary cone member having at its apex a bottom inlet and provided upon its inner inclined face with a plurality of longitudinally arranged grinding teeth, a vertically disposed drive shaft arranged above and concentric to said stationary cone member, means for adjusting said shaft vertically, means for rotating said shaft, an upper rotary cone member nested within the lower cone member and provided on its outer inclined face with a plurality of longitudinally arranged grinding teeth, and a gimbal joint connection suspending the rotary cone member at the top from the lower end of the drive shaft.

ORE-CONCENTRATOR.—No. 892,057. Frank G. Janney, Salt Lake City, Utah.



In a concentrator, a rotary reciprocating table having outer compartments for water to receive the material to be treated and having a peripheral rim projecting above the surface of the table, and means for subjecting the water to a jigging motion during the reciprocations of the table.

FLUID-PRESSURE-OPERATED DRILL.—No. 902,836. Andrew F. Ross, Long Island, N. Y., assignor, by mesne assignments, to The Pittsburg Pneumatic Co., Canton, Ohio, a corporation of New Jersey.



In a fluid pressure operated drill, the combination with a cylinder, of a piston reciprocating therein, a tool rotatably supported by the cylinder in position to receive the impact of the piston, non-rotative direct connections between said piston and the shank of the tool, and means for imparting rotary motion to the piston during its reciprocations.

Publications Received.

Any of the books noticed in these columns are for sale by or can be procured from the MINING AND SCIENTIFIC PRESS.

HANDBOOK OF SMALL TOOLS, COMPRISING THREADING TOOLS, TAPS, DIES, CUTTERS, DRILLS, AND REAMERS, TOGETHER WITH A COMPLETE TREATISE ON SCREW-THREAD SYSTEMS. By Erik Oberg. 12mo., pp. 526, 282 illustrations. New York. John Wiley & Sons. 1909. Price $3 net.

The merit of this treatise consists in explicitly setting forth the procedure for obtaining the best results by their intelligent application according to the underlying mechanical principles involved. It is thoroughly practical, but also deals with the theory of shop work, giving the basis for calculating the details of work required for desired results, as well as tables from which the data may be taken in most cases by those unfamiliar with the use of formulas. The text is clear and elucidative. As an example of the practical hints, the following extract will be interesting:

"The principle involved in common drill-presses where the drill is given a rotary motion simultaneously with the forward motion for feeding, is the one least adapted to produce a straight and true hole. Better results are obtained by giving only a rotary motion to the drill and feeding the work toward it. It has been found, however, that for drilling deep holes the reversal of this, that is, imparting a rotary motion to the work and the feed-motion to the drill, will answer the purpose better. It seems as if there could be no material difference between the latter two methods. An analysis of the conditions involved will show, however, that there is a decided difference in the action of the drill. If the drill rotates and the work is fed forward, the drill when deviating from its true course will be caused to continue to deviate still more by the wedge action of the tool when the work is fed forward. In the case of the work rotating, and the drill being fed forward, the point of the drill when not running true will be carried around by the work in a circle, thus tending to bend the drill in various directions. The drill is, by this action, forced back into the course of least resistance, as it is evident that the bending action being exerted on the drill in all directions will tend to carry the point back to the axis of the work, where no bending action will appear."

MINING AND METALLURGICAL INDUSTRIES OF CANADA, 1907-08.

This report has been issued to meet the increasing demand on the Department of Mines for information on the mining and metallurgical industries of Canada, which are attracting interest from all parts of the world. The work comprises 936 pages of text, descriptive of all the metalliferous and non-metalliferous mines, and of metallurgical and clay industries in the Dominion; illustrated by 44 engravings and drawings, and mineral maps of the respective Provinces. The maps alone render the report a valuable acquisition. They are up to date as regards the topography of Canada and the positions of known ores and commercial mineral deposits which are being worked are indicated. A brief historical sketch prefaces the industrial review of each Province, and a description of the magnitude, equipment, and mode of operation of every important mine and plant is given; together with the capitalization and personnel of each organization or company. In the copious index some 1500 names of owners or companies are recorded alphabetically. Unfortunately, care has not been taken in regard to the names, many of which are in error. While the report is a directory of the mining and mineral industries of the Dominion, it differs in not being a mere inventory. In addition to the specification of the many mines and industrial concerns, it contains historical notes, geological monographs, analyses of materials, descriptions of equipment, and statistical tables. Inasmuch as the production of the report has been costly, the Department has seen fit to publish it at $1, so as to ensure it reaching the hands of those directly interested in the practical development of the mineral resources of Canada. All communications with regard to the report should be addressed to Dr. Eugene Haanel, Director of Mines, Ottawa.

Great Falls Water-Power.

Work is progressing rapidly in connection with the 72,000-hp. development on the upper Missouri river in the vicinity of Great Falls, Montana. The diverting coffer-dam at Rainbow falls has been completed, so that the engineering force can get into the bed of the river to make surveys for the power-house and head-works, and actual construction on the dam is under way. This coffer-dam is built of stone and dirt, and is not intended to be absolutely tight. A second coffer-dam is being built, that will be permanent, and inside of it the actual construction work is being done. Plans for the dam and masonry at the head-gates are complete. Those for the power-station and machinery contained therein will be made later, at the Boston offices of Chas. T. Main, the engineer in charge of the development. An engineering building has been constructed for the engineering force, containing a drafting room, living room, sleeping room, and a bath-room. This building will be steam heated and electrically lighted from a temporary plant. A spur track from the Great Northern railroad has been built into the plant, a distance of 7000 ft. The type of dam which has been designed is a rock-filled timber crib, covering a large area of the bed with a wide apron. The lumber for the dam has been delivered. At the Great Falls of the Missouri the program is practically the same as that at Rainbow falls. The diverting dam is partly built and the surveys in the bed of the river are being made. It is expected that this work will be carried out at the same time as that at Rainbow falls. No contracts will be let, as the Great Falls Water Power & Townsite Co. is doing the work.

Commercial Paragraphs.

The CYCLONE DRILL CO. has recently opened a Chicago office at 419 Fisher Bdg. It will be in charge of J. F. Munn, who has been manager of the core-drill department at Orrville.

The A. LESCHEN & SONS ROPE CO., St. Louis, is distributing an attractive circular which gives several views of the new St. Louis cathedral, the occasion being the fact that more than two miles (exclusive of guys) of Hercules wire rope is in use on the large derricks used in the erection of the structure.

The U. S. FLEXIBLE METALLIC TUBING CO. advises that the San Francisco house has moved to its permanent quarters at 63-65 Main street. The company invites a call from all patrons and friends, and would be glad to show all styles of metal hose carried in stock and to explain the elaborate tests made on all shipments.

The FOOS GAS ENGINE CO., Springfield, Ohio, reports the installation of one of its 36-hp. gas engines and producers at the property of the La Esperanza Mining Co., Zacatecas, Mexico. The plant has been running steadily for two months, requiring an average of 75 lb. charcoal per 24 hr., which amounts to a cost of one cent per horse-power-hour.

Catalogues Received.

The ROBINS NEW CONVEYOR CO., New York and Chicago, in Bulletin No. 1, shows the various uses of the well-known belt-conveyor and the best methods for keeping it in efficient condition.

THE JOSHUA HENDY IRON WORKS, San Francisco, describes in Bulletin No. 14 every variety of its Tangential Water Wheels, from monsters of 50 ft. in diameter to miniatures of half that number of inches. More particularly we notice the wheel designed by J. M. Nicol for heavy duty and high pressure, whereby removing and replacing buckets is accomplished with ease, without sacrificing the rigidity which is necessary to preclude vibration.

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EDITORIAL.

READERS of this journal will note a pleasant vein of reminiscence in a letter which we publish this week from Mr. Almon D. Hodges, Jr., where he refers to the late Almarin B. Paul as a "welcome visitor to the office of the MINING AND SCIENTIFIC PRESS." That was many years ago, away back in the sixties, when Mr. Hodges with his splendid German training, came as part of the vitality and power of the new West to the development of its resources, and, among other activities, for a period edited the MINING AND SCIENTIFIC PRESS, giving it a technical importance it has ever since retained. We may add that Almarin B. Paul was not alone distinguished for converting the tedious patio process into a method in keeping with the spirit of the times, but later took the initiative in crushing ores in cyanide solution. He was in the van of progress and lived to see the perfecting of many metallurgical ideas that were evolving twenty years ago and developed into the practice today.

ENGLISH mining companies are proverbially persistent; like the old guard, they may die but they never surrender as long as a chance remains of prolonging the fight for success. Therefore when one mine 'peters out' they take an option on another—somewhere else, anywhere else—for being globe-trotters and also administrators of world-wide empire, it matters not whether the mine be in Burma or Bulawayo, in Vancouver or Van Dieman's Land. The last name reminds us of the Briseis Tin Mines Ltd., a company operating in Tasmania. Having decided upon "a policy of expansion," the Briseis company instructed its consulting engineers, Messrs. Lake & Currie, to co-operate with its resident manager, Mr. C. Lindesay Clark, in the inspection of gravel mines such as offered a prospect of enlarging the income available for dividends. In consequence, an option was taken on 2000 acres of dredging land in the Yakandandah district of northeastern Victoria, a region already the scene of successful dredging. It is estimated that there is gravel enough to keep four or five dredges busy for eight or ten years, with a profit of 3 to 5 cents per cubic yard in a deposit about 30 feet deep. Having a tin mine nearly exhausted, a cash reserve of £30,000, and abundant credit, this new venture appears commendable. We hope it may prove in every way successful.

OUR New York correspondent mentions the pessimistic tone of the copper market. We confess that the situation does not appear cheerful, for it is known that many important mining companies are holding their product of copper for better prices, thus gradually increasing the threatened condition

of an over-supply. In this connection we may quote the story of a well-informed American who was in London in the latter part of the year and on being asked if a large stock of copper existed in the United States, he confidently answered in the negative. The next day he was invited to meet some prominent bankers who showed him the records of a loan of £5,000,000 on copper stored in New York. We give the story for what it is worth, receiving it from a trustworthy informant. At least, it will emphasize the need of a clear statement concerning the supplies of metal. As yet the Copper Producers Association has done nothing; is it that the truth if published would demoralize the market? Undoubtedly the copper mining industry would gain by being made less dependent on the gambling operations of a metal market, the nature of which is obscured by lack of information. We hope that the leading producers of copper will rise to the needs of the occasion by insisting upon publishing trustworthy statistics.

Destination of Transvaal Gold.

The Rand mines are managed from England, but the remittances of bullion follow the drift of exchange. Thus the destination of the South African gold is frequently determined while it is still afloat, in accordance with the shifting direction of trade-balances. The recent trend of gold has been to the Bank of France. This became pronounced in August last, and has continued so persistently that universal attention has been drawn to the financial power of that country which for the moment seems to be the world's banker. France has been the money-lender to nations in need of help throughout the financial crisis; her resources have appeared to be inexhaustible; nevertheless the stream drawn from her vaults by foreign borrowers would have depleted the stock so jealously guarded in the Bank of France save for protective discounts. The gold reserve has been unflinchingly maintained above $500,000,000; in spite of enormous loans it stood at the end of January at $717,000,000. This accumulation had been partly at the expense of the Bank of England, and partly through attraction of the gold remittances from the Transvaal. It is a remarkable fact, unprecedented in the previous history of gold mining, that a single group of mines could be so depended upon for a steady contribution as to be reckoned a definite factor in the forecasts of the money-market. With the regularity of a machine the Rand sends forth its monthly quota of $12,000,000 in shining bars.

During January the drain upon the Bank of England reserve has been greater than ever, due to preparations for the Russian loan of $300,000,000, of which only $30,000,000 at 88¾ had been apportioned to London bankers. Since December 3 practically all the Transvaal gold had been absorbed by Paris. These determined efforts to secure the yellow metal have been attributed by certain critics, with a show of 'inspiration', to political motives, which, if it have any warrant, can only refer to the Moroccan settlement in which Germany has just displayed a complacent mood. The more probable explanation is the need of maintaining a proper ratio between the reserve and the expanding business relations of France with the rest of the world. As a recuperative measure the Bank of England has been raising the discount rate to divert gold, inclusive of the Transvaal remittances, to London. Raising the discount rate, which is tantamount to making a dearer market for advances of cash, may seem a peculiar way of attracting gold, but it is in reality nothing more than another manifestation of the familiar law of supply and demand; the bank rate increases with the demand; this attracts foreign gold seeking the prevailing elevated rate of interest; and gold so attracted must, under the existing order in the European countries, find its way to the great central banking repository.

Goldfield Consolidated Report.

Among 'Company Reports', on another page of this issue, will be found an abstract of the second annual report of the Goldfield Consolidated Mines Company for the year ending October 31, 1908. This report is disappointing, both as to the information given and as to the manner in which that information is presented. Criticism is proper, for the directors responsible for the issuance of the report are in control of the most important gold mine in America, the shares of the company are quoted on the exchanges of San Francisco and New York, and among the owners of the mine are bankers of high character of whom the best financial methods may reasonably be expected. Moreover, the report is a matter of public interest on account of the 6000 stockholders to whom, in the first place, it is addressed. Viewed from the stockholder's standpoint, this annual report does not afford the fundamental data requisite to an understanding of the condition of the mine. The essential details to which every stockholder is entitled are: a clear statement of the financial transactions during the fiscal year; an account of any work of construction undertaken or completed during that period; a straightforward description of the development of the mine, with a full statement of the results, particularly the prospects on the lower levels; finally, an estimate of the tonnage in reserve and its average value. As regards the first two items, the report performs its duty; but as regards the development of the mine and the ore reserves, the data given are insufficient and unsatisfactory. Thus, in referring to the important question of the persistence of the orebodies below the 400-ft. level, it is stated: "On the 600 level, the lowest level of the mine, an orebody 20 feet wide has been cross-cut and connected by raises with the same orebody on the 450 level, proving beyond doubt that in this portion of the mine good ore is continuous from the upper levels to the 600." The only other information on this point is found in the statement of rich ore extracted from a winze and from a short drift, as quoted in full in our summary on page 262 of this issue. Having regard to the importance of the question of persistence, the stockholders are entitled to more precise information; to an experienced miner the description as

given in the report is not convincing, nor is it adequate. The winze was sunk last April; why is the exploratory drift only 100 feet long? Good ore undoubtedly exists at 600 feet; that is not the only point at issue, but what amount of ore is there on that level, and how does it compare with the 400-foot level? That is the question that every intelligent stockholder will ask. It has been suggested that the orebodies go down like carrots; for aught that the report says this may be true.

It is patent to those familiar with such documents that the frightful discrepancy between the estimate of ore reserves as given in the last annual report and that given this year is the underlying reason for such lack of definition as obscures the report. In our issue of December 21, 1907, we commented on the inadequacy of the evidence given in the first annual report as to the amount of ore in reserve; insufficient evidence warrants skepticism as to conclusions, in mining as in other affairs. In the first annual report the general manager said that "if the bonanza and low-grades are treated together in a mill, I believe there is developed ready for extraction and treatment 1,000,000 tons of an average value of $25 per ton, which should yield a profit of $17 per ton." In the second annual report another general manager states that the mine "from the surface to a depth of 400 feet, will produce at least as much as has already been extracted, namely, $15,000·000." To complete the basis of comparison, it must be added that all the reserves included in the first estimate were in the ground above the 400-foot level, so that the two estimates can stand side by side. In the second appraisal no tonnage is given, for good reasons. In other words, there has been 37,000 feet of development done since the first annual report, $2,300,000 has been taken out, and yet there is a net shrinkage in estimated reserves of nearly $8,000,000. On the face of the report, the mine is worth $8,000,000 less this year than last, without reference to a shrinkage in the probabilities and possibilities below 400 feet. For this result and for the statement obscuring it, we do not blame Mr. J. H. Mackenzie, the general manager. That Mr. Mackenzie was able to get the fact out at all is greatly to his credit, for while it has been known to mine-operators for months, the directors of the Goldfield Consolidated did not publish it to their shareholders.

As to the mine itself, the report indicates in every line that it is in the hands of a capable, cautious, and honest manager. Obviously, in giving reasons for not stating the bare ore reserves, but emphasizing the difficulty of making an estimate and then hazarding an approximation of the gross recovery above the fourth level, Mr. Mackenzie is trying to do the mine justice and to preserve a cautious attitude. Those possessed of experience in such matters will infer from the report that the orebodies are decreasing in richness and size in depth. From the report it is possible by analysis to arrive at the tonnage now available: As 600 tons are to be treated daily, or 210,000 tons annually, and as dividends are promised at the rate of 30 cents per quarter, or $1.20 per annum on 3,546,000 shares, making a total of $4,250,000 in dividends, therefore it is evident that a net profit of $20 per ton is expected. The working costs are put at $6 per ton, and if we allow $2 per ton for development, additional plant, and general expenses, we have a recoverable value of $28 per ton, from which, allowing a 95% extraction, we infer that the average value of the ore is estimated at about $30 per ton. Dividing the $15,000,000 gross by $30, gives 500,000 tons as the tonnage in reserve above the 400-foot level, that is, enough for two years and four months, or $2.80 per share in dividends. Add to this about $1,000,000 of liquid assets or 30 cents per share, we have slightly over $3 per share assured above the fourth level. It is said unofficially that an extra dividend of 30 cents per share is expected annually; if this be so than the ore reserves will be that much sooner exhausted. If on the other hand our estimate of the average grade of ore is low, then the tonnage is too high. We have made such inferences as are warranted by a slight knowledge of the mine, a wide experience with annual reports in general, and a careful reading of this one in particular. Assuredly, the average stockholder to whom the annual report is addressed will be no better able than we to get at the facts concerning his mine and if any of our inferences are not quite correct, it is due not to prejudice or sinister purpose, only to inability to get information where it does not exist.

With this digression, we come to the ratio between the value of the stock as quoted on the exchanges and the evidence to support the correctness of that appraisal, which is $8. At this price some $5 per share must be found below the fourth level, plus interest on the money while that $5 is being won. Now we can see what the plunger at $8 per share gets for his $5 risk. Dividends at the rate of $1.20 per annum represent 15% on the current quotation. If an 'investor' wants his money back (for every mine has its day) with interest at 8% (and 8% is low enough in all conscience for a gold mine of such erratic orebodies), then the mine must continue to pay this 15% for 11½ years. As there is ore enough for 2⅓ years above the fourth level, there must be found sufficient for 9 years below that level. As $15,000,000 is good for 2⅓ years, then 9 years will require about $60,000,000 worth of ore, that is, twice as much as has been taken out of the mine *plus* what remains above the fourth level; in fine, the mine must continue to 1200 feet as good as it has been above 400 feet. Everybody who knows this type of ore deposit and who reads the annual report will be aware that there is no warrant for either the belief or the expectation of a continuation below 400 feet, in tonnage and value, as above that level. The prospective value of the mine is undoubtedly great, but when a man appraises that prospective value on the basis of $5 × 3,546,000 or $17,730,000, plus interest on this sum, while waiting to get the $5 back, he is not an 'investor', nor even a 'speculator'; he is a punter with a willingness to give long odds. Either the Goldfield Consolidated is tremendously overvalued or the two annual reports are waste paper.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

A. C. Beatty is at Los Angeles.

R. H. Campbell is at New York.

Albert F. Holden is at Salt Lake.

W. L. Leland is here from Los Angeles.

H. C. Hower is on his way to New York.

F. W. Bradley has returned from Mexico.

Edwin J. Collins has returned to Tonopah.

John F. Allen, manager for the Caucasus Copper Co., is on his way to Batoum, from London.

W. E. Thorne came to San Francisco from Auburn this week.

W. F. Ferrier spent a few days in San Francisco this week. He is now at Kennett, California.

Charles W. Abbott has joined his father, James W., at Pioche.

J. H. Baker, now with Phelps, Dodge & Co., is at Fresno, California.

B. H. Bennetts has opened an office at 3821 North 35th St., Tacoma.

James Douglas passed through San Francisco on his way to New York.

W. R. Rust, manager of the Tacoma smelter, was in San Francisco this week.

B. Britton Gottsberger is resident manager for the Tennessee Copper Company.

Ralph Nichols is consulting engineer to the Latest Out mine, at Gilmore, Idaho.

T. S. Mathis of Berkeley, Cal., was at the new camp of Courtland, Arizona, recently.

L. C. Graton has become statistician for the Copper Producers Association at New York.

G. D. Nevile-Wyatt and A. T. French are leaving England shortly for Famatina, Argentine.

Albert Bordeaux has returned to Thonon les Bains, France, from a four months trip in South America.

John H. Talbot is superintendent of the Calumet & Arizona mines at Courtland, in Cochise county, Arizona.

Whitman Symmes has gone to Virginia City, where he will act temporarily as superintendent of the Mexican mine.

D. M. Ryan has resigned as superintendent of the Mexican, Union Consolidated, and Sierra Nevada mines, on the Comstock.

E. W. Carson, of Los Angeles, has been appointed mine superintendent of the Picacho Basin Mining Co. near Yuma, Arizona.

Gus. A. Coenen has been appointed superintendent for the Walker Lake Gold M. & M. Co. with offices at Sacramento, California.

F. E. Steele, formerly at Deadwood, S. D., is in the employ of the Creston-Colorada M. Co., at Minas Prietas, Sonora, Mexico.

Hooper & Speak have been appointed general managers of the Great Boulder Perseverance mine in Western Australia. For the last three years the firm has acted as consulting engineer to this mine.

J. Parke Channing, owing to pressure of work as consulting engineer to the General Development Company, New York, has resigned as president of the Tennessee Copper Co., while continuing to be a director of that successful mining and smelting corporation. His office will be henceforth at 42 Broadway.

Obituary.

Bert Peterson, manager of the El Rayo mines, died at Los Angeles on February 10.

Latest Market Reports.

LOCAL METAL PRICES—February 11.

Antimony	12@16c	Quicksilver (flask)	44½@45½
Electrolytic Copper	15¼@16½	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33¼c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 4. £. s. d.	Feb. 11. £. s. d.
Camp Bird	0 16 0	0 15 6
El Oro	1 2 6	1 3 9
Esperanza	3 0 0	3 0 0
Dolores	1 10 0	1 10 0
Oroville Dredging	0 8 9	0 9 0
Mexico Mines	5 0 0	4 17 6
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Feb. 5	13.18	4.05	5 01	52
" 6	13.18	4 02	4.98	52⅜
" 7	Sunday.	No market.		
" 8	13.18	4.02	4.98	52¼
" 9	13.18	4.02	4.96	52⅛
" 10	13.18	4.02	4.92	51⅞
" 11	13.18	4.02	4.88	51¾

SOUTHERN NEVADA STOCKS.

San Francisco, February 11.

Atlanta	$ 14	Laguna	1.30
Belmont	85	MacNamara	36
Booth	22	Manhattan Con	5
Columbia Mtn	15	Midway	22
Combination Fraction	1.10	Montana Tonopah	76
Daisy	75	Nevada Hills	1.55
Fairview Eagle	30	Rawhide Queen	40
Florence	3.97	Sandstorm	13
Gold Bar (Bullfrog)	1	Silver Pick	10
Goldfield Con	8.00	St. Ives	15
Gold Kewenas	23	Tonopah Extension	70
Great Bend	22	Tonopah of Nevada	6.05
Jim Butler	15	Tramp Con	10
Jumbo Extension	15	West End	31

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Feb. 4.	Feb. 11.
Amalgamated Copper	75¼	77½
American Smelting & Refining Co	84¾	87¾
Boston Copper	13	13⅛
Butte Coalition	24	24½
Cumberland Ely	8⅜	8⅜
Dolores	7	7
El Rayo	3⅜	3¼
Giroux	8¾	8⅛
Greene-Cananea	10½	10⅜
Indiana Sonora	4¾	4¾
La Rose	6½	6⅜
Miami Copper	13¼	14⅜
Nevada Consolidated	18¼	18⅜
Newhouse	5⅛	4⅞
Nipissing	9⅞	9⅞
Ohio Copper	6½	6½
Tennessee Copper	40	41⅛
Utah Copper	43½	44¾
Yukon	4⅜	4¾

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. February 11.		Closing prices. February 11.
Adventure	8½	Miami	14½
Ahmeek	165	Mohawk	65
Allouez	40	Nevada Con	18¾
Amalgamated	77⅞	North Butte	76
Arcadian	4¼	Old Dominion	52¾
Atlantic	16¾	Osceola	132
Boston Con	13¼	Parrot	28½
Butte Coalition	24⅝	Quincy	91
Calumet & Arizona	106	Rhode Island	—
Calumet & Hecla	650	Santa Fe	2¼
Centennial	32¼	Shannon	16½
Copper Range	76¼	Tamarack	82
Daly-West	10	Trinity	15⅛
Franklin	15½	United Copper Con	14
Granby	101½	Utah Copper	44½
Greene-Cananea, ctf	10½	Victoria	4¾
Isle Royale	30⅞	Winona	5¼
Mass	5½	Wolverine	146

(By courtesy of E. F. Hutton & Co., 490 California St.)

General Mining News.

ALASKA.

F. G. Monley's drill has been closed down for the season, but the Monley holdings will be worked extensively this coming year. On Thanksgiving creek there are 600 ft. of bedrock stripped ready for the first run of water. Jerome Chute, who in the early days of Dawson was one of its largest operators, has acquired large holdings in the Glenn district; on his Eureka creek property, there are 1500 ft. of top-covering removed ready for the spring thaw, and several hundred feet of bedrock uncovered ready to shovel into the sluices as soon as the weather permits. Chute believes that by drilling through the bedrock he may strike a flow of water to use for sluicing. With this idea in view he has installed a drill on American gulch, a tributary of Eureka creek, which will soon be put in operation.

The 'insiders' of the Fairbanks district are delighted at the news from Washington, D. C., that the postmaster general has increased the amount of mail matter which may be carried into the interior in winter time. The increase allowed is 48,000 lb., and will certainly be taken advantage of, as loads of mail have often had to wait for the opening of the summer service.——A copper nugget weighing three tons will be exhibited by Alaska at the Alaska-Yukon-Pacific exposition to be held at Seattle.——Numerous reports have been heard of rich strikes being made in the Koyukuk country. H. P. King, of Cordova, writes how satisfactory the developments on Nolan creek have been. Pay dirt has been found for two miles along the creek, and the benches on the left limit are showing up well.

ARIZONA.

COCHISE COUNTY.

The capacity of the Southern Arizona Smelting Co., which at the present time is 700 tons, will be increased to 1400 tons daily. When the Sasco smelter was built its capacity was but 300 tons. A second furnace was added, giving a capacity of 700 tons. This amount of ore is furnished from the Imperial mines and custom ores cannot be treated. In fact the mines can supply more than the smelter is able to handle.

GRAHAM COUNTY.

The Arizona Power & Water Co. has just been incorporated in Arizona by D. M. Potter and G. F. Reed. The company proposes building two large dams above Clifton for the purpose of generating power for any who require it. The first dam on the San Francisco river will be 100 ft. high, unless present plans are changed. Eight water appropriations have been secured, four of which are on the San Francisco river and four on Black river, which no doubt are sufficient to meet all future demands.

MOHAVE COUNTY.

A 10-stamp mill has been hauled out to the mines of the Expansion Gold Mines Co. at Union Pass, where it will soon be installed. It is the intention of the company to put in a complete plant, capable of treating 40 or 50 tons per day, and later, when sufficient water for a large plant is developed, more stamps may be added.——L. Hoffman, who has been examining the mines of the Arizona Southwestern Copper Co., reports that the water coming from the mine is so strongly impregnated with copper that tools in the shaft are almost instantly plated with the red metal.

PINAL COUNTY.

D. C. Jackling has been appointed general manager for the Ray Consolidated Copper Co. He now holds that same position with the Utah Copper Co., and will design the new smelter on a modified plan of that at Garfield. The smelter will be built in sections so that the same plans can apply to a 500-ton as to a 3000-ton smelter. To increase the capacity sections will be added as required.——The Copper Creek Mining Co., adjoining the Calumet & Arizona near Mammoth, is busy at construction work under the management of Roy Sibley. It is now erecting a 500-kw. central power-station of which the first unit has just been completed. It is also constructing a concentrating mill, which will have a capacity of 250 tons daily. At the top of the 3-compartment shaft is a fine double-drum electric hoist, and all the rest of the equipment is on the same scale.

YAVAPAI COUNTY.

The Maguire mines have been sold by A. J. Pickrell to the directors of the Arizona Gold Mines Co., and the final payment has been made.

YUMA COUNTY.

The Arica group of gold mines, in the Parker district, has been bonded by the Williams brothers, from Mrs. C. H. Gray, of Phoenix, who is the principal owner. The vein at a depth of 190 ft. is said to be 6 ft. wide.——Ames Sterling, former head of the Australian geological survey, is examining the geology and petrology of the Clara Consolidated Gold & Copper Mining Co. for the manager, George Mitchell. Progress is being made by that company in the preparation of its smelter site, and nearly all the machinery is on the ground.

CALIFORNIA.

ELDORADO COUNTY.

Nearly 100 mining location notices have been filed with the County Recorder since the first of the year.——R. E. Garetson, C. McClellan, and others, who recently bonded the old Gray mine near Shingle, have bonded the Golden Hatchet gravel mine, on Webber creek.

INYO COUNTY.

As a result of the recently held annual meeting of the Four Metals Co. at San Jose, orders have gone out to double the furnace capacity of the smelter at Keeler. A gasoline engine has been ordered for the mine to augment the steam engine already installed there, and an extension of the electric line of the company on Lone Pine creek has been made. Power will be generated at Lone Pine and Keeler for public use. The smelter when enlarged will have a capacity of 300 tons daily.——Some ore from the 160-ft. level of the Bishop Creek Gold Co. has been tested by Ricketts & Banks, of New York, to find its suitability for treatment by cyaniding. They used the new Moore-Clancy process, and obtained an extraction of 90% on the ore, the heads of which ran $20 per ton.——Three tons of $600 silver ore have been brought by George Cook to Keeler from Nemo canyon in the Skidoo district. The forty miles of road are in fair condition.

NEVADA COUNTY.

The lower adit at the Magnet is in 500 ft. and is advancing rapidly. Driving is being done with machine drills operated by air compressed by water-power from Canyon creek. Cross-cuts will be driven from the main adits to intersect the parallel veins. Frank L. McPherson is superintendent.

PLACER COUNTY.

It is reported that A. Maltman has been appointed manager of the Three Stars mine and that he has begun pumping out the shaft. Maltman lives in Grass Valley and is also manager of the Ethel mine in Nevada county.

SHASTA COUNTY.

The First National Copper Co. has three furnaces in blast at Redding, giving a total capacity of 1500 tons per day. All of the equipment is new and the converters have not been operating long enough for the company to determine how high grade a matte the furnaces will yield. The company is handling the ores of the Trinity and Balaklala Copper companies, the Balaklala ores being handled as part of the company's properties, while the Trinity ores ore handled as custom work. In addition, silicious ores are being drawn upon from several of the Nevada camps.——A more favorable rate for the shipping of quartz ore to smelters has been announced by the Southern Pacific. Heretofore the least charge has been 75c. per ton. Following are the new rates for carload lots of a minimum weight of 15 tons. From Redding to Kennett, Keswick, Coram, and Pit, ore

not exceeding $10 per ton, 50c. per ton; over $10 to $30, 75c.; over $30 to $50, $1; over $50 to $100, $1.20.——An electric locomotive has arrived for the Hazel Creek Gold Mining Co., to be used in the Gladstone mine at French gulch. The main working tunnel of the Gladstone is 4000 ft. long, and strikes the vein at a depth of 1000 ft. from the surface.

SIERRA COUNTY.

W. F. Sherwood and M. Green have taken a bond on the Bullion quartz mine near Sierra City. The Bullion was formerly called the Colombo, and has had some good rock extracted in the past. Work will be commenced early in the spring.——Some rich 'specimen' rock has been taken from the shaft at the Red Star mine at Alleghany. Rich rock has been taken from several places in the tunnel during the past few months, but this is the best they have ever come across.——The extra five stamps have been put in place at the Papoose mill and now ten stamps are kept constantly dropping on good rock. John Taylor is in charge of the mill.——The gasoline engine that is used at the No Better shaft at Forest has got obstinate again and refuses to work. The management has been forced to cease operations until it is repaired. At present the shaft is about 175 ft. deep.

TUOLUMNE COUNTY.

The Nervy Gold Mining Co. has the distinction of having a lady as president. Miss F. M. Colby is spending a good deal of money in developing her property near Columbia, and now has at least 500 ft. of backs ready to take out. The old mill on the Nervy is useless, but Miss Colby has secured from Conlin Bros. a bond on their holdings at Italian Bar, including the Golden Era mine and mill.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The Griffith group of mines on Griffith Mtn. was sold this week by order of the United States District Court at Denver. The property was bid in by W. D. Hoover, of Denver, the principal owner in the defunct Griffith Mines Co., the consideration being $65,000, the full amount of which was paid in cash. Mr. Hoover is now organizing a new company to clean out the old levels and re-timber the stopes and drifts. Work is shortly to be put under way upon the construction of an electro-chemical milling plant with a capacity of about 50 tons daily.——To satisfy a judgment obtained from the District Court of Clear Creek county on January 6, 1909, the sheriff has sold to F. C. Pannill and W. J. Kie the Little Flat group of claims situated at Idaho Springs in the Jackson district. The property brought the sum of $8092. It is reported that a new company is being organized to develop their new acquisition.——A number of tests have been made lately at the Georgetown adit in running a Sigafoos tunneling machine, which consists of a frame carrying ten cutting or crushing heads that strike by means of a spring, and work on the whole face of a drift at the same time. As yet the pumping station has not been put in operation, and until plenty of water is available it will be impossible to state with any degree of accuracy the results obtainable. However, ground has been broken at the rate of one inch per minute. A big force of men is being employed, both by the Georgetown M. T. P. & T. Co. and the American Rotary T. M. Co., and it is hoped to have everything in readiness for the real tests during the next few days. The machine, which weighs 56 tons, is now about under cover, showing that it has already drilled nearly 20 ft.——Word was received in Georgetown this week that work will at once be resumed in the Kelly adit, the entrance of which is situated on Democrat Mtn. within the corporate limits of the town. It is understood that a working fund of $60,000 has been provided. All outstanding indebtedness has been liquidated by the manager, Jerome Smith. The 50-ton concentrating mill will also be put into commission on ores from both the Moline and Boston adits. In the drift run on the Boston vein a body of lead ore is exposed that is from 2 to 5 ft. wide, and worth from $55 to $60 per ton in silver, lead, and zinc. On the Deming vein there is showing a body of mill ore that is from 5 to 9 ft. wide, worth from $14 to $16 per ton. The aerial tramway is to be repaired to permit of the prompt delivery of the ore to the mill-bins. The Kelly adit is now in a distance of 2800 ft.——The Commonwealth vein was recently cut by the Wilcox adit, and showed lead ore from 12 to 16 in. wide, worth $55 per ton in silver and lead. In sinking a winze on the same vein a streak of smelting ore has just been exposed that is from 2 to 3 ft. wide. D. F. Sprousse states that shipments will be discontinued until the Argentine Central railway has been opened for traffic in the spring. The 125-ton concentrator is running steadily and is treating ore from the Wheeling vein.

Georgetown, February 6.

LAKE COUNTY.

The property known as the Forest Lode claim, owned by the New York & Texas Gold Mining Co., was sold several years ago for delinquency of taxes, and has never since been worked. Now considerable interest has been aroused because it has been purchased by Osborne A. Butcher, of London, England; and it is wondered if discoveries of ore have been made.

TELLER COUNTY.

The new plant at Stratton's Independence began operations shortly after the new year, and has been running light for about fifteen days. During this period the general manager, Philip Argall, reports that 500 tons of $7 ore were treated. The machinery is adjusting itself and the tonnage to be treated during February will be materially increased.——The output of the Cripple Creek gold mining district for the month of January reached the total of 61,728 tons with a gross value of $1,362,274. As compared with the closing month of 1908 a decrease is shown in tonnage of 6272 tons, but with an increase in value of $2200. ——A cave on the second level of the No. 1 property of the Portland mine completely filled the 'Queen of the Hills' stope. No one was injured when the rock fell, as the stope has been abandoned for some time, but the immense dump above the caved portion sank several feet and it is estimated that 8000 tons of dump fell through.——H. P. Dahl, of Cripple Creek, owning and operating the Coriolanus mine on Battle Mtn., has started a cross-cut from the northeastern lateral of the United Mines tunnel to a point under the shaft, from which he will raise 100 ft. to connect. Ventilation will then be perfected and it will be possible to operate 650 ft. from surface.——The lease on the Mable M. and Gold Dollar mines on the eastern slope of Beacon hill, formerly held by the Beacon Hill Mining & Development Co., has been formally transferred to the Union Leasing Co. C. G. Jackson will continue as superintendent for the new owners.——A gasoline hoist is to be installed at the main shaft on the Morning Star mine on Bull hill, by the Morris brothers, of Cameron, the lessees. These operators have opened up a promising orebody at a depth of 250 ft. and will shortly resume shipments. The property is owned by the Acacia Gold Mining Co.——Schwartz & Co. recently secured a lease on the dump at the Gregory shaft of the Elkton Consolidated Mining & Milling Co.'s Princess E. mine on Raven hill. A small milling plant is to be erected with solution tanks to treat about 25 tons daily. The dump accumulated for the most part during the time of the Hayden lease.——At the annual stockholders' meeting of the Portland Gold Mining Co. the old board of directors, with Frank G. Peck as president, was re-elected. The report shows a gross production for the year of 94,311 tons having a gross value of $1,834,080, the average value per ton being $19.45. The total expenditures were $1,278,029, making the net earnings $588,839, out of which amount $480,000 was paid in dividends. The company has been trying the Tippet-Crowe and Moore-Clancy processes on its ore and also a process which will be known as the Portland process. These tests have sufficiently demonstrated that crude ore can now be treated, thus effecting a saving of 76 cents per ton for

roasting and $1 per ton for transport to Colorado Springs. The company now proposes to erect, at an early date, a 300 or 500-ton mill at Victor to put the Portland process into practical operation.

IDAHO.

SHOSHONE COUNTY.

(Special Correspondence).—A circular letter has been issued to the stockholders of the Amador company advising them to meet the assessment of two cents per share which falls due on February 15. It is stated that both the mine and the smelter are in good condition and that but few repairs will be necessary to the railroad. To date upward of $25,000 has been collected on the assessment. Another letter to much the same general effect has been issued from Chicago. The latter of these two circulars states that all the charges made against the manager have been investigated and found to be untrue.——Work is about to be resumed on the property of the Iron Mountain Tunnel Co. which lies just across the Idaho-Montana State line. It is the intention to clean out the old shaft and cut a station on the 1600-ft. level and then to install machinery. The company has paid out over $1,000,000 in dividends.——A 15 foot vein of copper ore has been disclosed by the diamond drilling recently begun on the Missoula Copper company's property in the Mullan district. The core was extracted from a northwesterly direction from the face of the adit, and another hole will be bored in a northeasterly direction to prove the length within reach.——A 25-foot vein carrying lead and silver, some of which asays as high as 63% lead and 23 oz. silver per ton, has been opened up in the property of the Iron Mask Co. The vein was cut at the end of a 900-ft. cross-cut and has been drifted on for about 100 feet.——Four feet of good concentrating ore has been opened up in the property of the Amazon-Dixie Mining Co. operating a group of claims in the Lookout district. The ore was found at the end of a 525-ft. drift and at about 200 feet from the surface. The ore asays 18% lead and 7 oz. silver. In May an 1100 ft. adit will be started at a point 36 feet from the tracks of the Northern Pacific railroad and 2000 feet east of Copper creek. The company will erect new boarding and bunk houses, two concrete dams—one on the St. Regis river and one on Copper creek—connecting with the power plant by means of a 9000 ft. steel pipe. At the same time the present compressor will be taken out and one of at lest 10-drill capacity installed. The cost of the improvements will be between $25,000 and $30,000.——A force of men has been set to work to dig out the machinery recently covered by a snowslide at the property of the Full Moon mining company. If the men are successful in this work development will be resumed at once; but if the machinery cannot be rescued at this time, work will have to be resumed by hand. ——Patrick Burke and his associates, who took an option some time ago on the Oro Fino group of claims near Murray, have made a first payment of $10,000. The option involves the sum of $40,000 and the final payment of $30,000 is to be made by November. It is believed that the property will ultimately be consolidated with the Black Horse Mining Co. of which Burke is president.——The famous tailing suits, affecting almost every producing mine in the Coeur d'Alene have at last been finally settled, according to a telegram received by C. W. Beale, the attorney for the mining companies. This telegram stated that the United States Supreme Court had denied the application for a writ of certiorari and had ordered the cases dismissed. The application for the writ was from the Circuit Court of Appeals at San Francisco which had decided against the ranchers. It was sought to have the Supreme Court revise the proceedings and this was denied. The cases were those of Timothy McCarthy and others v. the Bunker Hill & Sullivan, Hecla, Snowstorm, and Federal Mining & Smelting Co.'s mines, and involved an application for injunction based on the claim that the tailing from the mines which had been dumped into the Coeur d'Alene river had poisoned cattle and rendered ranch land unfit for agricultural purposes.

Wallace, February 3.

MICHIGAN.

The Tamarack Mining Co. will institute diamond-drill operations on its Cliff property, at a point about half a mile north of the Ojibway No. 1 shaft. This portion of the company's property has already been thoroughly explored, so it is supposed that this is for finding a suitable position for a shaft site.——The Michigan Copper Co.'s stamp-mill on Keweenaw bay will be completed in about three months. The machinery is all on the ground and a large part of it has already been erected.——The vertical shaft of the Hancock Mining Co. is now being sunk below the fourteenth level and the cross-cut east to connect this shaft with No. 1 is progressing at a rate of 200 ft. per month. It is expected to have the two shafts connected by April.——Adventure is still searching for the Lake lode which the Lake Copper Co. is working so successfully. The lode is supposed to traverse the south side of the company's holdings and much drilling has been carried on. Ten holes have been bored and three veins intercepted that give some promise. But so much do these three veins resemble on another that it is difficult to determine the one sought.——The annual report of the Copper Range Consolidated Co. for the year ending December 31 shows a creditable record for Baltic and Champion, while Trimountain and the Globe have been distinctively disappointing. The two first have each been producing about 70,000 tons per month, running 22 to 23 lb. copper per ton. Trimountain has been so low-grade that the cost per pound of the copper produced was about equal to the selling price, leaving no profit; and the Globe property has been finally abandoned after an expenditure of $600,000. However, the combined operations of the company have been successful enough to enable them to pay dividends of $4 per share. Diamond-drill exploration is in progress near Mill Mine Junction, where hopes are entertained of cutting the extension of the Atlantic lode.

MISSOURI.

JASPER COUNTY.

The severe wind storm which swept over the district last week caused a great amount of damage and forced a number of the mills to close down until repairs could be made. Elevators and tailing flumes were blown down and in the case of old and poorly constructed mills more serious damage was done—at times even the roofs being torn away. The storm will have caused a curtailment of the production for the week.——Among the new mills recently built is a sludge mill on the Cameron lease southwest of Joplin. This sludge mill is unique in many respects, as new methods are employed for treating the tailing and sludge. Its work is being watched with interest as it is hoped that a large amount of the slime-ore usually lost will be saved.

NEVADA.

ESMERALDA COUNTY.

The Nevada Black Marble Co. has started shipments from its quarries near Mina, sending the material to San Francisco. The deposit covers about 60 acres, it is claimed, and present cutting has opened it to a depth of 200 ft. Another deposit of marble in the State lies in White Pine county, not far from Gandy, but is a white and gray marble.——Active development will soon be re-commenced by Charles Worden on the property of the Marguerite Mining Co., about seven miles east of Walker Lake. A shaft has already been sunk 125 ft., disclosing 16 ft. of ore that averages from $12 to $16 per ton at the 60-ft. level. The deposit occurs at a contact between granite and limestone.——The Chamber of Commerce of Goldfield has received notification from the directors of the American Mining Congress that the next annual meeting of that body will be held in that city, thus ending the struggle waged by Seattle, Douglas, and other Western cities for the honor.——For the 10 months ending with January 1, 1909, the Pittsburg-Silver Peak Co. mill at Blair has averaged a monthly tonnage of 10,000 tons, with a value of $10 per ton. Of this amount 63% is saved by amalgamation on the plates, the cyanide plant effecting a

saving of an additional 30%. The output in this period amounts to $930,000. At the mine 153 men are employed, with an additional 80 in the mill, machine, carpenter shop, and on outside work.——The directors of the Rawhide Coalition Co. have granted a number of leases extending for a period of five years, which provide that the lessees must erect several mills and in addition develop the mines down to a depth of 500 ft.——Contracts have been closed by G. Vickers with the Woods-Sullivan Co. for a complete new 75-hp. equipment, including a double-drum electric hoist, skips, etc. This plant is for the Little Florence lease on the Combination Fraction, and the present 40-hp. gasoline hoist on the ground will be sold. The new equipment will enable the company to operate nine drills instead of three.——It is reported in Goldfield that the Diamondfield Daisy will resume shipments next week. The Daisy has not shipped for more than two months, but the superintendent, Charles Wilkinson, is confident that he can now maintain a steady output. ——At the new mill of the Florence Goldfield Mining Co., 90 tons of ore from the dump are being treated per day. It is hoped that the additional 20 stamps, or a complete battery of 40, will be running within a short time. Three shifts are being employed, and the number of men will be increased as conditions warrant. After the dump ore is all treated, rock from the lease workings will be handled. ——The first bar of bullion has been sent out from the new Florence-Goldfield mill. A saving of 65% is being made on the plates. Nearly three carloads of concentrate are ready for shipment, and the cyanide plant is doing good work.

LANDER COUNTY.

At the Shoshone Quicksilver mine, two miles from Ione, two retorts of six ovens are being operated. The output at present averages between 400 and 500 lb. of quicksilver per 24 hr., and they have about nine tons of mercury in flasks awaiting shipment.

LINCOLN COUNTY.

John A. Kirby has received bids for the farther sinking of the shaft of the Pioche King Mining Co., and will shortly give the contract for a 50-hp. gasoline engine.——George E. Coxe has made good progress with the shaft of the Gold Prince, as he is now down nearly 300 feet.

NYE COUNTY.

New refining furnaces are being installed in the Montana-Tonopah mill for the reduction of the cyanide precipitate to bullion. Previously these have been sacked and shipped by express, and it is believed that sufficient saving may be made by expressing bullion instead of precipitate to pay for the expense of the installation.——Harry Stimler and William Marsh, pioneers of Goldfield, have located a new gold camp in the Monitor range, 30 miles northeast of Tonopah.——The new ore rate at the Needles smelter has gone into effect. Ore from the Goldfield district will be handled at a reduction of $2.60 on $40 ore, and $2.75 on $15 ore. Ore from the Bullfrog district will be handled at from 50c. to $1 less than that from Goldfield. Other districts along the line of the Tonopah & Tidewater railroad will be similarly benefited by the reduction.——The Aldrich electric pump for the Tonopah Mining Co. has arrived and is being installed at the 1200-ft. station in the Mizpah shaft. All the 16-in. pipe arrived several days ago. The pumping capacity is 2000 gal. per minute and the pump is expected to handle all the water coming into the shaft.——The Bullfrog Chamber of Commerce is applying to the members of the Senate and Assembly of the State of Nevada to divide the county of Nye into two parts, at the Mt. Diablo base line. The Chamber of Commerce claims that the county is too large for good and economical government, and that the southern part has sufficient taxable property to support a compact well-managed administration.——All the machinery for the Kanrohat mill in Jefferson canyon is now at the mill-site. A force of 30 men is busy placing the two 5 and 7-ft. Huntingtons and enclosing the mill building. B. Jacques is in charge of the work and hopes to have the mill in operation by April 1.

STOREY COUNTY.

Due to the fact that a number of the miners have been put to work re-timbering the destroyed portion of Sutro tunnel, the Comstock output for the week fell off to $13,764, or nearly $2000 less than last week. Of this amount Ophir goes on record for $10,506.

NEW MEXICO.

GRANT COUNTY.

The Ridgewood claim at Sylvanite has been secured by E. L. Haff, consulting engineer, acting for the Eureka Sylvanite Mining Co. In addition to this the company has purchased the Euclid claim adjoining the Ridgewood, and the Jumbo claim adjoining the Pearl on the north, and this, with the Venus, Neptune, and Lakesight all owned by the company, gives them 240 acres of mineral-bearing ground. The officers of the company are: C. H. Morse, late of Cripple Creek, president; William B. Root, late of Denver, secretary and treasurer; Edward L. Haff, consulting engineer, and S. Camp is general manager of the property.

OREGON.

BAKER COUNTY.

August Mathez has been checking up the ore reserves of the mines of the Commercial Mining Co., in which Samuel Newhouse recently secured a large interest. Better results are being shown than were secured at the time the original inspection was made. The ore-shoot shows 12 ft. of $47 ore, the breast of the workings giving 6 ft. of $120 ore, and the deepest workings show 14 ft. of $16 ore.

UTAH.

SALT LAKE COUNTY.

A bill has been introduced into the Legislature to create an Office of State Mines, with an inspector who shall have jurisdiction over each and every metal mine in the State, and shall visit them at least once in every three months. The bill's number is 42, and is being introduced by Holman, of Salt Lake.——The U. S. S. R. & M. Co. are putting 1280 more sacks in the baghouse at Bingham Junction to more completely remove all the particles in the gases which are considered detrimental to vegetation and animal life. The original plant consisted of 2100 bags, and was the means of securing permission from the courts to continue the operations of smelting the silver-lead ores.

The Utah-Apex Co. is now in charge of the Phoenix Mining Co., and the Phoenix mill has begun to turn out concentrates for the Utah-Apex Co. The mill at present is treating 50 tons of crude ore per day. The company is shipping between 50 and 60 tons of first-class ore direct to the smelters. About three weeks ago connections were made with the Boston Consolidated spur railroad, and now all first-class ore shipped by the company is handled without the use of horses and teams. The gross earnings of the company are now estimated at about $1800 per day.

WASHINGTON

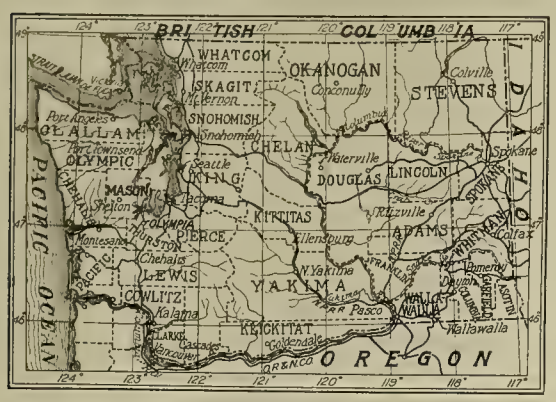
FERRY COUNTY.

(Special Correspondence).—The New Republic Co. has reported having 32 men on its pay-roll, of whom 22 are breaking ore in the Republic mine. The mine is being gradually cleared of debris from the caving in of the several levels, since it was closed down, in the fall of 1901. The caving had made the first, second, and third levels almost inaccessible, but the cleaning up has done much toward revealing several valuable deposits that were either in sight when the mine was closed down or have been exposed by the caving. The first carload of ore shipped by the new company assayed $74 per ton, or a gross value of $3848. So far no returns have been made by the smelter. Ore is being mined in several places on and above the fourth level.——The lessees of the south end of the Surprise claim, belonging to the Pearl Con. Mining Co., have drilled through from the new workings into the bottom of the shaft and drained off the water. They are now raising to make a working connection.——Five men are employed on the lease of the In-

surgent mine. The lessees shipped 32 tons of ore, making the seventeenth shipment since the beginning of the original lease. The first work done by the lessees consisted in driving an extension of the lower adit of the Pearl Consolidated Mining Co., on the Lone Pine vein, following it into the Insurgent ground.——The Belcher mine is being operated under the supervision of Bruce White, former manager of the Slocan Star, in West Kootenay, B. C. He has been at the Belcher mine since last November, and is now engaged in development work with 12 men. He has driven through 50 ft. of payable ore on the No. 2 level and is now blocking it out to determine its size. The ore taken out is piled on the dump, there being no present way of shipping it. The assay office at the mine is in charge of A. H. Burns, who was formerly with the Bunker Hill & Sullivan Company.

Republic, February 3.

William Scheck, manager for the Germania Tungsten Mining Co., owning 2000 acres of land in Stevens county, has closed a contract with steel manufacturers in Germany for the entire output of the property. The 40-ton mill will be enlarged and operated to its full capacity and the force will be increased to 50 men. The company plans to build a road to Springdale, the nearest shipping point, thus reducing the haul to 12 miles instead of 20 miles as at present.——The report of the United Copper Mining Co. states that there are approximately 200,000 tons of ore in sight



Map of Washington.

and that of this, 100,000 tons has a gross value of $10 per ton. Six thousand feet of development have been done, and of this 2965 ft. were accomplished in 1908. Three thousand tons of ore were shipped in 1908, and there are now 200 tons of ore broken ready for shipment. Conrad Wolfle is president and manager; Gale Smith is treasurer; and the property is six miles from Chewelah.——A new process of smelting copper ore has been exhibited at West Seattle during the last month. The furnace itself is built of brick, is 20 ft. long, 7 ft. wide, and 8 ft. high, lined with firebrick, containing two hearths sloping from the extreme ends of the furnace to a well at the centre, from which the matte and slag are tapped, and has a capacity of 25 tons per day. Crude oil and steam at 90 lb. pressure are admitted and combine in the ore chamber just above the charge, in such a way that roasting is in progress at one end of the furnace and smelting at the other. The process is stated to be continuous.

WYOMING.

CONVERSE COUNTY.

Edwin Hall, general manager for the Copper Belt Mines Co., states that the company's shaft, south of Lusk, is now the deepest in the State, having reached a depth of 620 ft. The ore-shoot was lost at a depth of 280 ft., but the shaft was continued and again struck ore at a depth of 600 ft. The company is now shipping its sulphide ore. The Copper Belt is in a new district, north of the Hartville iron and copper region.

CANADA.

BRITISH COLUMBIA.

For the purpose of taking over the Kootenay Chief and Comfort mining claims, near Kootenay Lake, J. A. Whittier and Louis Pratt have organized the Kootenay Chief Mines Ltd., with a capital of $500,000 in shares of $5 par value. The head office of the company is at Kaslo.——William M. Williams, familiarly known among the miners as 'Black Billy', one of the pioneer gold-seekers of British Columbia, claims to have discovered veins of platinum ore on his property in the Teague group of claims, some thirty miles south of Hope.

MEXICO.

Pedro Alvarado, owner of the Palmilla mine, now operated under lease by an American syndicate, has formed a company to take over many mines of the Parrall and adjacent districts in Chihuahua. It is stated that over 70 mines are embraced in the merger, and that the company will have a capital of $25,000,000. It will be financed in Mexico and the United States and incorporated under the laws of New York.——The unwatering of the old workings of the San Cayetano mine, owned by the San Cayetano Mines Co. at Guanajuato, is progressing under the direction of William Tanguey, superintendent, and Frederick H. Clark, the general manager of the mine. This unwatering will affect not only this mine, but will also drain two of the mines of the Reduction & Mines Co., whose workings are adjacent.——C. B. Bell has made the first payment to Carlos Soto for the Monte Cristo mine in the Lampassas district of Sonora, in the sum of ₱50,000. Bell's partners in his purchase are C. H. Jones and Frank Douglas, and the total sum to be paid to Soto amounts to ₱400,000. Soto worked the mine himself for many years, but so irregularly that the development was not properly kept up to pace with the extraction of ore.——A bill has been prepared and introduced into the Mexican Congress, under the direction of the Department of Mines, for the purpose of advertising the mineral resources of the Republic of Mexico. Under the provisions of the bill as introduced, exhibits such as the Mexican Central now displays at Chihuahua, will be established at Juarez, Torreon, Zacatecas, Aguascalientes, Queretaro, and Mexico City.——Potter Palmer, of Chicago, has purchased the Promontorio silver mine at Cusihuiriachic, in Chihuahua, for ₱250,000. The former owners were F. Delgado and B. Barcenas, of Guadalajara. This mine is 13 miles from the Chihuahua & Pacific railroad, and has only been worked in a small way during the last four years.——H. Lawrence Read, of Australia, has formed a company in England for the purpose of exploiting the Potter process in Mexico, and will establish an ore-testing plant in the vicinity of the City of Mexico.——Three properties in the Naica district, the Cia. Minera de Zola, Cia. Minera Sensitiva, and Cia. Minera Carolina, have been organized in Parral as a new company under the name of the Cia. Minera Emilio Zola y Anexas de Naica, S. A., with a capital stock of ₱200,000, divided into 4000 shares of a par value of ₱50.——The International Smelting & Refining Co. has purchased the plant of the Compañia Metalurgica de Torreon, on the recommendation of E. P. Mathewson and D. L. Ricketts, who lately reported on its condition.——The Ajuchitlan Mining & Milling Co., at work near Ahorcado, in the State of Queretaro, has been operating by electric power, taken from the Queretaro Power Co., with extremely efficient results. The company has ordered from G. & O. Braniff & Co., agents for the Westinghouse Co., several new motors, transformers, circuit-breakers, etc., and is also installing a new electric pump.——The San Francisco del Oro Mining Co., operating in the Santa Barbara district, Chihuahua, has suspended operations and will be reorganized.——The Green Gold Silver Concession having lapsed, the Department of Fomento threw the territory open for the filing of mining claims on February 8. There has been a rush of prospectors to the district to take advantage of the opportunity.

Special Correspondence.

JOHANNESBURG, TRANSVAAL.

Summary of Conditions in 1908.— Policy of Consolidation. — Metallurgical Practice.—Stope Drill Contest.—Mining Commission.

The year 1908 has been marked by so many notable events which have furnished good cause for satisfaction, and progress in all branches of the Rand gold-mining industry has been so substantial, that it is only possible to cover the outstanding features quite briefly, within the limits of this fortnightly contribution. Summarized, the following are the chief points calling for notice: (1) Increased aggregate tonnage, owing to the rise of new producers, to stamp-battery extensions, and to further addition of tube-mills. (2) Increased total yields and profits. (3) Reduced yields and costs per ton. (4) Share-market improvement and consequent financial activity, providing funds for sound schemes of expansion. (5) Good deep-level developments in the Central and Far Eastern Rand. (6) Greatly improved labor conditions, despite Chinese repatriation. (7) Numerous mine consolidations. (8) Erection of central electrical power-stations. (9) Drafting of a new gold-law and the publication of mining commission's report. (10) Modifications of mining and metallurgical practice.

At the time of writing, statistics for the whole year are not complete, but gold production is not sufficiently steady to enable the totals to be estimated with absolute accuracy. Output and dividends for the Transvaal since the war display the following record of progress:

		——Dividends——	
			Percentage
Year.	Yield.	Total.	of Yield.
1902	£7,301,501	£2,121,126	29
1903	12,628,057	3,345,502	26½
1904	16,028,883	3,877,624	24
1905	20,854,440	4,832,436	23
1906	24,616,704	5,735,161	23
1907	27,403,738	7,131,212	26
1908	*29,700,000	8,748,612	*29½

*Estimated.

The high percentage of the yield available for distribution in 1902 was largely due to the fact that only the richer mines were re-opened at first, so that the 1908 proportion is significantly creditable, being the dividend-margin upon the working of comparatively low-grade ore. Throughout the period there has been a gradual fall in grade consequent upon the growing activity of poorer mines and upon the policy of cutting down costs so as to bring the poorer parts of all mines into the range of probability. Thus it will be gathered that the tonnage of ore has risen more rapidly than the yield of gold. At the beginning of 1907, the yield per ton averaged 34s., at the close of 1907, 33s., and today it is 30s. 6d. per ton. This fall is simply due to the change in industrial conditions, and provides the apostles of pessimism, who have so frequently attempted to dishearten the ignorant with alarming predictions of a consistent fall in the value of ore with increasing depth, with no cause for self-gratulation. As the dividend statistics demonstrate, the decline has been more than balanced by the increase in the quantity of ore milled, together with the reduction in working costs. Even during the year 1908, the average expenditure has been reduced from 19s. 10d. to 17s. 3d. per ton milled. Though several mines appear to have reached the economic limit in this direction, with their total working costs in the region of 12s. to 13s. per ton, the Rand's average will certainly show a still further improvement, during the current year.

To whatever abuses the demand for reduced costs may have led in certain cases, where low-grade ore has been exploited in excess, it is at least certain that the policy has been appreciated to its full in European financial circles and that the return of favor has been largely attributable to the evidence thus provided of the application of stringent economy. At the same time progress has been brightened by two or three important developments which strengthen the prospects of future success in areas yet beyond the productive sphere. In the Central Rand, for instance, the Village Deep has been improving in depth, and also the adjacent City Deep, in which two shafts have cut the reef at a depth exceeding 3000 ft. In this mine it is claimed that half a million tons of ore are developed, having an average recovery-value of about 40s. per ton, which is higher than the grade of ore in the neighboring mines nearer the outcrop. Again, in the Far East Rand basin, in a part hitherto untouched by shafts, the Brakpan mines cut the reef at a depth of 3695 ft., where it assayed 16 dwt. across a width of 81 inches.

The cloud of depression due to a shortage of unskilled labor, which hung over the Rand for two or three years after the war, has been gradually lifting. When the repatriation of the 50,000 imported Chinamen was decided upon, the prospects of the mines looked distressful. Fortunately, however, the tally of departures during the year has been exceeded by that of new arrivals from the Kraals of Portuguese territory and other parts of South Africa. The policy of increased economy enforced upon the mines has led to far higher efficiency in the ranks of the skilled white workers—especially since the strike of 1907—but the number of white men employed has been increased nevertheless by 2000 during the year. The totals for all the Transvaal gold mines for January and November 1908 are:

	Whites.	Kaffirs.	Chinese.
January 1908	17,522	133,515	33,849
November 1908	19,460	160,504	12,192
Difference	+1,938	+26,989	—21,657

The increase under the first head reflects in some measure the result of employing indigent white men upon work not requiring skill in order to relieve the acute distress experienced owing to retrenchments at Kimberley and other centres of employment at the beginning of the year. Although natives have been offering themselves in such unprecedented numbers, it must not be concluded that the industry is now proof against the restrictive influences of a shortage in future. The prospective needs of the field, estimated in the light of projects of expansion already planned and commenced, can only be satisfied if this increase be steadily maintained or, if an efficient small stoping drill is produced, capable of profitably displacing hand-labor in the narrower workings.

The most significant feature in a review of the past year has been the carrying into effect of numerous consolidations. The benefits of the policy of working in large units under a single management having been so clearly established, the mining houses have now decided to apply it wherever practicable. The scheme was initiated in a small way four or five years ago by the merging of the Crown Reef and the Pioneer, the Ferreira and the Worcester, and the Village Main Reef and the Wemmer. More recently, the following amalgamations were effected; Henry Nourse and Nourse Deep; Angelo Deep and South Angelo; West Rand Mines and Violet Consolidated; the South Rose Deep, South Geldenhuis Deep, Rand Victoria East, and Rand Victoria with the Simmer Deep; and the Jupiter and the Simmer West. This year the policy has been continued on a larger scale with the consolidation of the Village Deep and Turf mines; the Modderfontein Extension with surrounding properties; the Angelo, Driefontein, Cason, New Comet, and other holdings; the Kleinfontein Deep and Van Ryn Deep and lastly, in December, the Crown Reef, Crown Deep, Robinson Central Deep, Langlaagte Deep, Paarl Central, etc., into the world's greatest gold corporation, the Crown Mines, Ltd. This latter scheme, it is true, awaits confirmation by shareholders, but its favorable reception has removed all possibility of important opposition. With a capital of £1,000,000, in shares of 10s. each, the Crown Mines, Ltd., takes over four

producing mines with five mills now accounting for 1,600,000 tons of ore per annum, yielding £2,700,000 and earning from £1,400,000 to £1,500,000 in profits. As the life is estimated, on a basis of 1,800,000 tons milled per annum, at 50 years, the capacity of plant will undoubtedly be raised high above the present combined standard in course of time.

In Rand metallurgy, there have been several changes in practice, without affecting general principles. The erection of large electrical power-stations on the Rand is leading rapidly to the application of electricity to all the main units of power-consumption, and the new batteries in the East Rand are being driven by this means. The opposition of rival power-companies has been dispelled, so that during 1909 and 1910 electricity is likely to win its proper place, after long delay, as the chief prime-mover in modern Rand engineering. The Simmer Deep mill of 300 heads, electrically driven in units of 10, was completed in September. At this mill we see the general tendency of employing heavier stamps conspicuously illustrated. By the addition of compensating weights, a standard weight of 1650-1700 lb. is maintained. Tube-mills have increased in favor, the number at work in December being 120, as against 72 in January. By their extended use, the average stamp-duty on the Rand has been raised to 8 tons per 24 hours. Below the mill there have been no radical changes to record. The Adair Usher process for slime-treatment has been more extensively adopted, and 26 companies in the Transvaal were employing it at the close of the year, as compared with 11 at the beginning. In underground work, the most noteworthy feature has been the reduction of working costs, due principally to the improvement in personal efficiency. The standard of a good day's work has been steadily raised and enforced by the employment of more highly trained and qualified men in the minor positions of control. The stope-drill competition at the close of 1907 from which the Gordon drill emerged an easy victor, appears, in one respect, to have borne no good results, for the Gordon, in its present form, has failed sorrowfully under the stern test of actual practice. Interruptions and expenses due to wear and tear have been extensive. On the other hand, the trials have taught a valuable lesson and have prompted the Government and the Chamber of Mines to arrange a more decisive competition to be carried out this year for prizes of £4000 and £1000, apart from awards to the operating miners. The former trial may be considered to have been a costly 'dress rehearsal,' but it has enabled the present committee to draw up a set of rules and conditions leaving no loop-hole for misinterpretation of results. The number of machine-drills employed in Rand mining is about 2400. Records have been established during the year in the East Rand. With hand labor, the No. 2 vertical shaft of the Brakpan mines, 42½ ft. by 9½ ft. in the clear, was sunk 204 ft., from 1690 to 1894 ft., in one calendar month, and the incline shaft at No. 1—19 ft. by 7 ft.—a distance of 223 ft. in a month, with six 3¼-in. machine-drills. In the Simmer Deep, a drive on the fifteenth level was carried 294 ft. in 61 consecutive shifts of 10 hr. each, one white man and six Chinese working each shift with three drills. The variation in the hardness of the 'blue' deep-level ground is not sufficient to make these records anything but surprisingly excellent.

The Transvaal Government early in March issued the report of the Mining Industry Commission, which investigated all questions of mining policy bearing on labor conditions. Under the chairmanship of F. H. P. Cresswell, the aim of this judicial commission was to force the mines to employ white labor, whether economically or not. The finding of the majority was expressed in a report so extreme in character that the Government, though favorable to the sentiments, found a pigeon-hole the most respectful grave to which it could be assigned with dignity. But if the deliberations of the Government's nominees were so absurdly barren of practical results, the same cannot be said of the labors of the ministers themselves. In the middle of the year the new gold law was drafted. Though not liberal enough in its provisions for outside prospecting and possibly too severe in its enforcement of work upon ground held under claim licenses, this bill, which is now in operation, is not seriously detrimental to interests on the Rand. The Government thus proved its intention to ignore the cries of the political faddists and the outlook was brightened by the removal of fears of opposition between Johannesburg and Pretoria. After a long period of instability, the Rand appears to have been re-established during the past year upon an improved and settled basis.

NEW YORK.

New Chlorination Method.—Standard Oil and Yukon Gold.—Guggenheim's Statement.—Copper Situation.

Mining men in New York are taking great interest in the Baker-Burwell dry chlorination plant recently erected in Montana to treat the Elkhorn tailing. Fuller details of the process are now available. The crushed ore, which may contain any combination of metals, is treated with chlorine gas while subjected to a temperature sufficiently high to cause the chlorine to combine with metals to produce volatile chlorides or soluble proto-chlorides. The process is carried out in revolving porcelain-lined tubes, or flint-mills having hollow trunnions and enclosed in a chamber of brick or boiler-iron, to facilitate heating the ore. The heating chamber is fired by gaseous fuel. Chlorine gas is fed to the tube-mill through the trunnions, which are also porcelain-lined. In the treatment of ores containing gold, silver, and iron sulphides, the tube-mill is charged to about one-third its capacity with ore crushed to about 50-mesh. The charging-doors of the mill, and its enclosing chamber, are sealed, and the mill is revolved. The ore is then heated to a temperature of about 150° C. Chlorine gas generated electrically from sodium chloride solutions is introduced into this mill and allowed to combine with the metals and with the sulphide. The sulphur and chlorine form sulphur mono-chloride, S_2Cl_2, which is withdrawn from the mill and condensed. The base metals in the ore are converted to proto-chlorides. When the formation of sulphur chloride ceases, which is shown when chlorine gas begins to pass to the condenser, the chlorine supply-valve is closed, and the ore is spread on a cooling-floor. When cooled, the ore is treated with water to dissolve the soluble chlorides. The free gold in the ore is saved by amalgamation, cyanide solution, or by wet chlorination.

It is persistently rumored in Wall Street that the Standard Oil people have acquired a controlling interest in the Guggenheim mining properties in Alaska, and that some large financial schemes will shortly be arranged preparatory to listing on the New York Exchange, where they are to be manipulated on the lines so profitably followed in the cases of the United States Steel and Amalgamated companies. President S. R. Guggenheim has issued a statement to the stockholders of the Yukon Gold Mining Co. regarding the present conditions of the property and future prospects. The gold in the developed ground is estimated at $40,000,000. The net earnings to December 31, 1908, are about $550,000. For 1909 the earnings will probably exceed $1,000,000. "I have no doubt," says President Guggenheim, "that the directors will authorize the commencement of dividends during the year, probably in the second quarter; but before deciding definitely as to the date and rate they deem it prudent to wait until the coming season's operations have sufficiently advanced to enable them to more accurately estimate the probable earnings for 1909. Early in 1906 work was begun upon a water system (now completed) which will insure to the Klondike a continuous water supply for all time. This involved the diversion of Tombstone river (the right fork of the Twelve-Mile river), carrying it 62 miles by flume, ditch, and pipe-lines through a country that was an absolute wilderness when the company's engineers went there. The water is carried across the wide Klondike valley in an inverted siphon, which for length, size, and pressure involved is not equaled in the world. In addition to these primary physical achievements," says President Guggenheim, "a huge dam has been built at the head of Bonanza creek to conserve the waters

of the Upper Bonanza water-shed for the use of the company's Bonanza and Eldorado creek properties. Seven giant dredges have been completed, and their operation has demonstrated the entire success of this method of mining as applied to the gravels of the Yukon. In 1910 we expect to show a production which will make the Yukon Gold company take rank as one of the largest gold mines in the world."

The statement intimates that the Guggenheim Exploration Co. still holds a controlling interest in the company. The controllers of the Exploration company are not disclosed.

There has lately been a large amount of pessimistic talk regarding the outlook for copper mining, and copper stocks have been heavy on all the stock exchanges. All kinds of wild stories are being scattered by the news bureaus regarding the piling up of copper stocks owing to the overproduction of copper. A prominent manufacturer, who is a large user of copper, is reported having stated that electrical plants are at present consuming copper at the rate of about 50% of normal, and the present consumption of copper in the United States is about 65% of normal. North American mines are producing the metal at the rate of about 1,350,000,000 lb. per year. Consequently about 35% of the present production is going into storage. It will doubtless be a long time, this manufacturer believes, before the price of copper advances. It appears that these pessimistic statements are being issued in the interests of the copper trust. Copper production at present is not as large as is believed.

BUTTE, MONTANA.

Butte & Ely Option.—Minnesota Mine.—Legalizing Consolidation.—Ponderay Smelter.—East Butte Company.

The Butte & Ely Copper Co.'s property is under option to the Cole-Ryan people. It is optioned in the name of T. M. Hodgens for $1.90 per share of the stock. The property is situated between the Giroux, recently acquired by the Cole-Ryan interests, and the Nevada Consolidated, controlled by the Guggenheims. It is said that the best ore found in the Nevada Consolidated ground is near the end line of the Butte & Ely. The latter owns a valuable water right, while the Giroux has no water. The small smelting plant, which was erected by the Giroux and which was afterward destroyed by fire, was to have been operated on water pumped from the mine. The Butte & Ely owns 12 patented claims of 210 acres. The company is capitalized for 500,000 shares at $5 par, and about 257,000 shares are outstanding. The option at $1.90 per share includes the treasury stock and the majority of the stock outstanding. It will expire March 1. The stockholders have elected the following officers and directors: R. M. Hodgens, president; B. E. Calkins, vice-president; A. L. Langley, treasurer; T. B. Moore and J. C. Adams. W. E. Wright is secretary. The company has done some development work, but stopped at the beginning of the financial depression.

The litigation between the Butte & Superior Copper Co. and John McAlpine, a stock subscriber, has been terminated, Mr. McAlpine abandoning his fight and paying the notes he had given in payment of stock subscriptions several years ago. He refused payment on the allegation that the value and condition of the property had been misrepresented to him. McAlpine, like many others, was let in on 'the ground floor', paying about $3.50 per share for the stock on rosy and misleading representations and promises of big advances and profits.

There will apparently be no litigation between the United States Government and the Amalgamated Copper Co. over the Washoe smelter-smoke problem. The company and the Government are now working together in an endeavor to find means for minimizing damage from the arsenic in the smoke.

What big things may be done in mine-promotion without capital is shown by a statement of the secretary of the Calumet-Corbin Mining Co., a concern organized in Michigan to exploit the old Minnesota mine at Wickes, Mont. The promoters get the property for $100,000, but have been required to pay only $2000 down, no other payment being due until the first of next October, when the company is to pay $15,000 more. Thereafter the remainder of the payments extend over a period of 20 months. Meanwhile the public is asked to buy the stock on the Eastern curbs. Under the option the company has the right to extract and ship ore while developing the property, but 20% of the net smelter returns must be applied on the purchase price where the ore value does not exceed $45 per ton, and 25% where the value exceeds $45. The original owners of the option on the property receive 26,000 shares of stock, $1 paid, which is held in escrow in the name of three trustees, which stock will be released only at the discretion of the board of directors. The Calumet-Corbin Co. was originated by several Butte men, who secured the option on the Minnesota.

A bill is before the Montana State Legislature providing that a corporation may own stock in another corporation, and it will undoubtedly become a law. It was introduced in the interest of the Amalgamated Copper Company.

Wilbur D. Greenough is quoted as saying that the Greenough brothers do not intend to give up their attempts to make a success of the Panhandle smelter at Ponderay, the property of the Idaho Smelting & Refining Co., in which they own a controlling interest. He says they have spent $55,000 in improvements. The smelting company has an indebtedness of $290,000 and the smelter is being operated at a loss. The company has authorized an issue of $400,000 worth of bonds, but only $100,000 have been issued. For some time the smelting company has had agents in the field trying to secure business, and the independent miners of Butte and other districts of Montana have been urged to patronize the smelter and make it possible for an independent plant to be maintained. The Ponderay smelter, after a long shutdown, was started up at the instance of the Montana Mine Owners' Association as a competitor of the smelter trust and the Amalgamated Co., which were accused of discrimination against the independent miners. It now appears that the latter are not patronizing the smelter as they should.

The East Butte Mining Co.'s concentrator will be completed and ready for operation shortly after February 1, after which, it is expected, the immense body of low-grade ore on the upper levels of the mine can be mined and handled at a profit. Some high-grade ore is being mined on the 400-ft. level, and the long cross-cut being driven south from the shaft at the 900-ft. level has cut three or four veins, several of which are of good size and bearing good ore. Driving is being done on the larger veins, the orebody in which assays 9% copper. The Amalgamated Copper Co. is mining on the same veins, both on the east and west of the East Butte ground. Complete harmony and a perfect understanding exist between the East Butte and its neighbors. An annual report made by the Raven Mining Co. shows that it has an indebtedness of $72,000, which explains the necessity of the recent appeal to stockholders that they subscribe to a block of treasury stock at $1 per share. The stock is quoted on the market at 75 cents.

At the annual meeting of the Butte-Montana Mining Co. it developed that control of the company was held by Pittsburg men, who favor a plan to increase the par value of the stock from $1 to $10 per share and to increase the capitalization about half a million dollars. The present capital consists of 1,000,000 shares. The company needs funds for development on the Alex Scott mine and to build a concentrator. The mine has a large quantity of low-grade ore in sight and could be made to pay. Some smelting ore is now being shipped. There is considerable opposition in Butte among the small shareholders to the new plan. The new directors elected are: J. P. Browne and W. H. Lindsay of Butte; J. G. Bennett, John B. Chapman, W. B. Chapman, and M. K. McMillan, of Pittsburg; R. A. Kerr of Duluth.

LONDON.

Refractory Material Standardization. — Institute of Metals. — Briseis Company's Expansion.—Cornish Mines.

The study of refractory materials has been taken up systematically by a body called the Committee for the Standardization of Refractory Materials. The secretary is Dr. J. W. Mellor, of Stoke on Trent, Staffordshire. The idea was originated a year ago by the English Ceramic Society and soon extended to the Institute of Gas Engineers. Strong support also came from the Iron & Steel Institute, and later on, the newly formed Institute of Metals joined the movement. A meeting was held on January 4, and preliminary arrangements were made for carrying out the work. The chairman of the committee is J. E. Stead, of Middlesbrough, and the vice chairman is J. H. Darby, of Brymbo, two gentlemen who are well known in metallurgical circles. The objects of the committee are to arrange and classify the various refractory materials, fireclays, ganister, magnesite, chromite, etc.; to arrange standard specifications for the raw materials and for manufactured products; to consider the possibility of arranging for uniformity in stock and standard sizes; and to arrange standard methods of testing and analysis. The procedure to be adopted is that individual members of the committee shall bring the matter before the particular institutions which they represent and obtain information and suggestions. In this way the committee will be divided into subcommittees which will conduct independent investigations. These will consist of the Ceramic Society division, one representing chemical and electrical work, another for glass, for gas engineers, pottery, metallurgy, and for general manufactures. The committee invites opinions on the following lines: (1) Materials at present in use, general information, analysis, etc.; (2) conditions of use, nature of furnace operations, temperature, and whether the temperature is continuous or intermittent; (3) criticism of materials at present in use; and (4) suggestions as to improvements both in material and sizes and patterns available; the Ceramic Society division will deal with, (1) the definition of refractoriness; (2) grades of materials, based on, (a) refractoriness; (b) class of material, whether aluminous, as clay and bauxite; silicious, as ganister and silica; and special, as magnesite, etc.; (3) the examination of raw materials, chemical analysis, standard method, of determining refractoriness, mechanical analysis, and behavior at various temperatures, shrinkage, porosity, plasticity. The manufacturer's division will prepare suggestions as to the elimination of odd and little-used sizes and shapes, standard sizes and shapes, deviation from specified dimensions in special sizes and as to the grading of clays as proposed by the English Ceramic Society. There is no doubt that the studies and information brought together by this committee will be helpful to metallurgists, and their cooperation is solicited.

The Institute of Metals held a meeting in London this week, when a preliminary report of progress was made. So far 273 members have joined, and the membership is spreading. Offices have been taken at Caxton House, Westminster, close to those of the Civil Engineers, Mechanical Engineers, and the Iron & Steel Institute. Arrangements are being made for establishing a journal and transactions. At the meeting this week Sir Gerald Muntz read a paper on research work which is of value to the metallurgist, and he appealed strongly to manufacturers and producers to communicate their knowledge and to abandon the old policy of secrecy. In fact it was a counterpart to the like appeal by James Douglas, and coming from a man who depends for his living on his special knowledge, it is all the more noteworthy. He showed that a great deal of knowledge runs to waste through secrecy, through the jealous fear of teaching something to a trade opponent which he has probably discovered also, whereas if the two frankly discussed the subject, each would give the other valuable hints which would make their total knowledge greater. With equal knowledge, it will still be the best man who will best apply it. If men have courage and confidence in themselves they need not hesitate to exchange information. Altogether, Sir Gerald's address was a frank condemnation of secrecy, but to what extent his confrères will meet his pleading is not quite certain. English metallurgists have never been communicative owing to their not being the owners of resources of raw materials.

The directors of the Briseis Tin Mines Ltd. have taken an interesting step by acquiring gold-gravel properties in the colony of Victoria. The company has for some years been working the tin-gravel mines of that name in Tasmania, and as the extent of the property is almost exactly known and the life of the mine is nearing its end, efforts have been made to acquire additional property. The Ringarooma tin property was purchased some time ago, and it should begin producing in about a year. In developing it, the engineers have decided to remove the overburden first,



Eastern Australia.

and so prevent a repetition of the series of mishaps that occurred at the Briseis by the valueless overburden occasionally falling in and interfering with operations. Already over 500,000 yd. of overburden have been removed at Ringarooma. Further prospecting has been conducted in Tasmania for tin, and probably when the Briseis water-supply becomes available on the final exhaustion of the mine, other properties not far off will be acquired. In the meantime the decision of the company to exploit gold-gravels in Victoria is interesting. These properties are being acquired from C. D. Wallace, a pioneer gravel operator, who has worked them by sluicing for some time. They are situated on Yackandandah and Sandy creeks, and extend over 2000 acres. The gravel is not encumbered by boulders or trees, and is comparatively easy to work. An area of 440 acres has been thoroughly prospected by the Briseis company's consulting engineers, Lake & Currie, and their general manager, C. Lindesay Clark, has made confirmatory examinations, and they find that on this area there is 19,000,000 cu. yd. of gravel that will yield 3 to 5c. per yard profit, taking 4c. as the cost of operation. Mr. Wallace will receive altogether £60,000, of which £15,000 will be paid in cash in three yearly instalments, and the remainder will be paid in the form of 20% of the yearly profits. It is expected that all the payments to Mr. Wallace will be made out of revenue, so that no new issue of shares will be necessary, but in view of the extension of the company's operations the name

of the company is to be changed to the Briseis Tin & General Mining Co. Limited.

The Wheal Kitty was the only mine in Cornwall to declare a dividend during 1908, with the exception of the small interim-dividend paid by Dolcoath in the early part of the year. The report of Wheal Kitty for the second half of 1908 shows equally good results, for a profit of £2204 has been made, a figure practically the same as during the first half of the year. As before, only £825 is being distributed as dividend, which is at the rate of 7½% per annum, and the remainder placed to the funds for sinking the Sara shaft another 540 ft. and equipping it, and for providing a modern dressing plant. About £10,000 is required for carrying out this work, and some of the additional capital has been subscribed. It is a bad time for raising money in Cornwall, and if the whole of the money is not forthcoming, it may be deemed necessary to continue putting aside a large proportion of the profits. During the second half of the year the mine produced 5541 tons of ore, yielding 119¾ tons of concentrate which sold for £10,152, or an average of £84 per ton.

Discussion is active in Cornwall over the lack of facilities given by bankers to mining companies and to other commercial enterprises in regard to granting loans. In the old days the Cornish banks were in private hands, and they were always ready to finance promising propositions, for the owners had intimate knowledge of their neighbor's standing and character, and indeed took large interest in local enterprises. Nowadays these banks have been absorbed by gigantic institutions in London which work by fixed rules and regulations, and cannot judge each case on its merits. Mining is therefore too risky a business for them. On the other hand, many of the mines here adopted the limited liability principle, which provides little or no security to the creditor. In the old days of the cost-book system, each individual was practically liable for the debts of the company, so that the bankers had a personal security for their loans. These two facts explain the reason why banks give so few facilities to mines nowadays.

NOME, ALASKA.

Labor Conditions.—Large Dredging Enterprise.—Difficulties of Mining on Seward Peninsula.—Mail Service.

The excitable stage in labor conditions, foreshadowed by the recent order of the American Federation of Labor and Western Federation of Miners of a $4 per day wage-scale, has passed. Only one camp in the Nome district is now a recognized union camp, namely, Waskey & Crabtree's. The Pioneer company has 12 hoists operating at Little Creek, all working non-union men, but nearly all the other operators have closed down rather than pay the union schedule. This prolonged resistance to the edict of the unions has suggested a solution of the problem. The local chapter of the Western Federation of Miners is proving itself thrifty and resourceful, and while the small operators are generally denied credit for supplies by the local merchants until the spring clean-up, the union is backing a syndicate of its own for obtaining supplies and to carry on the business of contracting and leasing mines. These operators pay cash for supplies, and they are working entirely for themselves, having no need to trust anyone else for the payment of their time-checks in the spring. A repetition of the $380,000 in unpaid time-checks floated in the Tanana district last year, seems to have been avoided. All business in Nome is on a cash basis this winter. Operators outside the W. F. M. Syndicate must pay cash for wages monthly; the merchants' combine demands cash for supplies and has started a blacklist of delinquents; the banks are refusing to loan money on dumps, on any pretext; and thus the merchants and banks get all the loose money anyhow, while the operators who have no cash with which to conduct operations must quit and give up to the Syndicate which is at work everywhere, while development and production from the mines is not altogether stopped, but only temporarily retarded.

Nome, in a business sense, as compared with former winters, is as dead as the proverbial door-nail. As stated, the banks and merchants have turned their backs on all operators who are without funds to carry on winter work and many of them must quit. These conditions are the result of finesse in trade combination, which in a measure will retard the development of the country, but in the outcome prepares it for favorable exploitation by capitalists and those who are interested in the trust. It is only a question of who is to control in a mercenary sense.

Claims well situated and many that have been known as steady producers, can now readily be purchased on terms favorable to the buyers. An immense area of placer ground has been optioned by New York promoters; this lies west of Snake river on the tundra toward Penny river. It is said to comprise 60 association claims of 160 acres each, which are to be worked by dredges of the Bucyrus type, with thawing plants capable of overcoming obstacles due to frozen ground. The deal is said to comprise all of the claims exploited by J. U. Picard in 1903, '04, and '05. One of the lessons taught investors by the failure of Picard's company was the necessity for mining syndicates to provide capital enough to supply their own outfits, direct from the States, to insure success. Investors who do not heed this injunction are courting disaster and disappointment.



Open-Cut Mining on No. 3½ Above Ophir.

Under existing conditions, the small operator, with limited capital, must pay exorbitant transportation rate to a combine which controls the shipping, lighterage, fuel, and food supplies of Seward Peninsula. At Seattle he is told that he "can get everything he wants in Nome at Seattle prices." In summer coal costs $15 per ton; in winter $20 to $35 per ton, and everything else is 'upward.' These facts he ascertains too late, for he has formed his company and provided himself with capital based on this false information. Arrived in Nome, he finds he must have more funds. The stockholders are scattered, and it is necessary to return to the States to present matters as they actually exist. The first season is thus lost. The investor in Alaskan industries must prepare well for all emergencies. Last winter many investors found their drafts repudiated; operators encountered the same conditions. These circumstances were unlooked for, and perhaps may not occur again, but they represent difficulties for which investors must be prepared. Nome business houses are the stockholders of the banks; they have set out to develop a cash trade; and the banks, accordingly, should have a large amount on hand to carry the work of this vast country. They are not carrying anybody, and investors thus are made to understand, that, even though transportation rates are high, it is far safer for them to bring in their own supplies, and whatever cash they need for all the emergencies that go to make up the rigors of an arctic winter, where even Uncle Sam requires six to ten weeks to transport currency wherewith to pay off his soldiers. Mail conditions in winter are improving and will continue to improve, a relay dog-team service being already in contemplation, which will trans-

port mail from Nome to Valdez in 12 to 14 days.

When railroads provide competition, and cheapen the price of living and supplies, then will ensue an era of prosperity in Alaska for the poor miner as well as for the highly financed operators. Until then only cautious and economical mining will insure success.

KALGOORLIE, WESTERN AUSTRALIA.

Total Gold Output.—Strikers Arrested.—King v. Ivanhoe.—Discoveries in Lake View Consols.—Dump Treatment at Oroya-Brownhill.

During the past eleven months the gold yield from all mines in the State reached a total of $32,000,000, that was $700,000 below the same period of 1907. The dividends paid this year were $6,500,000 against $7,500,000. Estimating the gold yield for December at $2,900,000, we have $34,900,000 for 1908; and as dividends for this month amount to $95,000 this total is $7,595,000. The grand totals from 1886 to 1909 are $420,000,000 in gold, and $93,900,000 paid in dividends. The November returns were as under:

Mine.	Tons.	Yield.	Profit.	Dividend.
Associated	10,664	$111,000	$ 36,000	$125,000
Associated Northern Blocks	3,660	38,000	13,000	.....
Golden Horseshoe	23,442	270,000	100,000	.....
Golden Ridge	2,185	27,000	13,300	.....
Great Boulder Proprietary	15,735	234,000	125,000	.....
Great Boulder Perseverance	17,436	133,000	35,000	.....
Great Fingall*	11,270	74,000	5,500	.....
Hainault	5,956	32,000	3,700	.....
Ivanhoe	19,031	207,000	105,000	.....
Kalgurli	10,815	148,000	81,000	.....
Kalgurli South	9,028	62,000	13,000	25,000
Lake View Consols	7,637	56,000	14,000	87,000
Oroya-Brownhill	11,455	80,000	7,000	.....
Oroya-Black Range	4,430	55,000	21,000	.....
Sons of Gwalia	13,274	92,000	28,000	.....
Sons of Gwalia South.	1,850	20,000	.....	.....

*Shut down part of month on account of wood strike in the Day Dawn district.

The second wood strike is at an end so far as Kalgoorlie is concerned, the leaders in the trouble being arrested for intimidation and sentenced to short terms of imprisonment. All is quiet again, but the presence of so many foreigners among the woodcutters is most undesirable.

The King *v.* Ivanhoe case, mentioned in one of my letters, has advanced another stage. The position to date is as follows: In the original case before the Supreme court of W. A., King got a verdict of $18,000 and costs. The Ivanhoe Co. appealed to the Full Court, which decided that the damages were excessive. The plaintiff then appealed to the High Court of Australia. This Court also considered that the damages were too high, thereby upholding the Full Court, and ordered a new trial. This was commenced before the Supreme Court a fortnight ago, and the case looked as if it were coming to a speedy termination, when two jurymen were arrested for trying to make a deal with King in order to influence the rest of the jury in his favor. It was through King that the jurymen were arrested, and it may be said that both parties in the case are entirely innocent. However, the judge dismissed the jury, and hung up the case till March next. The accused men are to stand their trial shortly. What is to be gained by all this litigation is hard to understand, but the plaintiff apparently is determined to fight to the bitter end.

During November there was a good development at 1900 ft. in the Lake View Consols. This mine has not been looking too promising of late, and the profits have been small, and as a result of this strike future prospects will be much improved. The extraordinarily high returns from a bonanza between the 300 and 400-ft. levels in this mine between May and November, 1899, may be remembered. The oxidized ore was rich, and the telluride ore shipped to the smelters was wonderful. The following are the returns for the months above mentioned:

Month.	Tons.	Returns.
May	8,450	$680,000
June	8,440	620,000
July	8,010	618,000
August	6,620	644,000
September	4,956	618,000
October	6,290	618,000
November	4,406	245,000

During this boom-time $5 shares rose to $150; but when the bonanza dropped out, they fell to $50 in a few days. Then came a series of changes in management until Bewick, Moreing & Co. assumed control, although this was a fearful scandal—the manager in 1899 cabling to his directors that he could keep up this large output for 2 years—no enquiry was held, as in the cases of the Perseverance and the Boulder Deep Levels' scandals of 1904, when the Government stepped in. When this present development was announced in the Lake View Consols, scrip mounted pretty smartly, but has fallen back to a more reasonable figure. This company has evidently a serious problem in the treatment of its old dumps by the Cassel process. From a report published, it appears that the assay before has been $2.90 per ton, and after treatment $1.34 per ton, giving an extraction of about 54%. As long as the soluble gold is all washed out, it is doubtful whether it would pay to go in for a longer treatment of this stuff. The new Cassel plant on the Oroya-Brownhill, to treat upward of 26,000 tons of old dump monthly has started work. The slime is trucked to a small hopper, elevated by belt conveyor to 2 vortex-mixers in series, agitated in 10 vats, and treated in 2 Cassel tanks, each containing about 25 frames. The tanks are filled and emptied by an 8-inch centrifugal pump, and the treated slime, when blown off the frames, drops into large mixers, and is pumped away to a dam. All the present mill tailing is also pumped away, the belt conveyors and boom-distributor being dismantled after making one of the finest dumps one would wish to see.

During the past month the mines used 30,398,000 gal. of water. Having had many days over 90, and several up to 108°F. in the shade, and several huge dust-storms, the consumption of water by mines and residents has risen considerably. The Water-Scheme officials are much worried over the corrosion of the steel pipes. External rust can be checked, but the internal corrosion is going to cost a lot of money. The water does this, in spite of the fact that analyses indicate nothing injurious. Much experimenting is now in progress.

The crank-shaft of the main hoist at the Great Boulder main shaft broke recently. At the point of fracture the shaft is about 13 in. diam. Repairs will be carried out in Australia, instead of sending to England. This hoist was made by Robey, of Lincoln, and is capable of hoisting 3 tons from a depth of 3000 ft. in 3 minutes. The new vertical hoist at the Edwards' shaft is now being erected. The new steel head-gear is practically finished, and the 'crackers' are now being put in. There is a size T Hadfield's gyratory for first breaking, followed by 2 of size R, and from these the broken ore will be taken to the mill-bins by belt-conveyor. The Ridgway vacuum machines are treating the regular mill pulp, the re-treatment of old dumps apparently being suspended indefinitely.

While not being in connection with mining, it may be of interest to mention that the pearling industry of the northwest of this State has suffered another severe shock. Last year a cyclone—or what is known locally as a 'cock-eye'—struck the various fleets, drowning a great number of whites and natives, besides inflicting about $200,000 damage. Last week another 'blow' occurred, and although the loss of life and the damage is not ascertainable at this writing, it will be considerable. The pearl shell gathered this year—10 months—is valued at $720,000, and the total value of shell and pearls since 1897 is about $9,750,000.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Storage batteries cost, erected, from $75 to $90 per kilowatt.

Colombia has adopted the gold standard, making the dollar the monetary unit.

The average price of carbon used in diamond drilling, during 1908, was about $75 per carat.

Ten inches of snowfall are equal to one inch of rain. This is the ratio used by the United States Weather Bureau in computing precipitation from snow.

Alcohol and gasoline engines when running under the most advantageous conditions for each, will consume equal volumes of the fuel for which they are designed.

Gold is valued in England, unless otherwise stated, on the basis of the British standard, which is $916^2/_3$ fine. The mint price per ounce is £3 17s. 10½d., equal to $18.9491. The mint price for gold 1000 fine is $20.671.

Oxygen equivalent, in relation to flue gases, is a term which expresses the sum of the volumes of oxygen, carbon dioxide, and one half of the carbon monoxide, calculated to its equivalent in oxygen as a means of comparison.

Manganese oxides and hydroxides are insoluble in water. They are soluble in warm hydrochloric acid, forming manganous chloride. The higher oxides in dissolving in HCl evolve chlorine, which is the basis of the old commercial method of preparing that gas.

Losses of gold in melting under the most favorable conditions would certainly be those recognized as within attainable limits at the United States Mint. Records kept at the San Francisco Mint show the following losses, stated in percentages: on bars, 0.00116; on dust, 0.03392; on 'retort', 0.05572; on unretorted amalgam, 0.64904.

Tungsten is used chiefly for hardening steel. For that purpose the consumption in 1907 was 5791 tons, but in 1908 it was greatly reduced. The consumption for making incandescent electric lamps is utterly insignificant. The annual output of such lamps in this country is about 10 million, and one ton of 70% tungsten ore will make 18 million lamps.

Zinc for gold-precipitation in the cyanide process should be as free as possible from iron. The presence of iron hastens corrosion, increasing the 'short zinc', and incidentally the consumption of both zinc and cyanide. The cause of this is open to some doubt. Evidently an internal zinc-iron couple is formed, but the iron is present in the zinc most probably as a mechanically included oxide. The action observed may be facilitated by the presence of carbon in the zinc. The subject is worthy of more detailed investigation than it has received. It is undoubtedly true that the deleterious effect is reduced by maintenance of a proper alkalinity in the solutions.

Grouting of cracks in foundations and walls should be done under pressure. This is accomplished by discharging the contents of a receiver filled with grout (which is a mixture of cement, fine sand, and water, of the consistence of cream) under air pressure. For this purpose an air pressure of from 80 to 100 lb. per square inch should be used. The edge of the crack should be pointed up, and allowed to set before filling with grout.

The Red Jacket shaft in Michigan is the deepest in the world, and has the most powerful winding machinery. The shaft is a mile deep, and the engines wind 10-ton cars of ore 1 mile at the rate of 40 miles per hour, or from bottom to top in 90 seconds. The shaft is so deep that the effect of the earth's revolution can be detected, for an object dropped always strikes the east side of the shaft before reaching the bottom.

Caissons have not been applied to shaft-sinking in placer mining, so far as we are aware. The process would be costly, and were there reason for sinking a shaft through watery gravels to reach bedrock-gold which could be worked subsequently by mining from the bottom of the shaft, the freezing process would apparently be the more economical. We cannot, however, conceive conditions in placer ground where material could be mined that necessitated such means for its approach.

Piping in steel ingots may be overcome to a large extent in various ways. Harmet has applied compression, the metal in the mold being forced toward the narrow end so as to induce radial pressure. The compression begins while the metal is still molten. Sauveur introduced a so-called continuous mold, the metal filling all the sections of the mold and covering the partitions. The piping will occur mainly in that portion of the mass above the partitions, and can be cut off. Another simple method to reduce the evil of piping is to cast the ingots with the small end down. The extra pressure prevents deep piping in an ingot so cast.

Diamonds at the Premier mine, near Pretoria, Transvaal, are found in 'pipes' consisting of a highly altered material largely converted into serpentine, and carrying fragments of country rock. These fragments have been brought up from deeply seated formations. Among the most common minerals other than serpentine are olivine, enstatite, hypersthene, chrome-diopside, garnet, ilmenite, biotite, vaalite, magnetite, epidote, apatite, calcite, and zeolites. Tourmaline, corundum, cyanite, barite, and rutile are also present. The original rock is supposed to have been peridotite. The outcrop is yellow to brown, but in depth it has a blue color, similar to the diamond-bearing 'blue-ground' of Kimberley. The volcanic pipe has traversed Paleozoic rocks.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Slickensides.

The Editor:

Sir—In many mines the vein or lode lies in a fault-fissure and the walls of the fissure are slickensided showing a smooth or polished surface with striations, grooves, or fluting. The California earthquake of 1906 was due to a fault-movement, which has raised the question of the prevailing direction of fault-movements in general. To get information bearing on this question I desire to assemble observations on the orientation of slickenside striations. To make observations in the mine, it is necessary to note the strike and dip of the wall upon which the striations appear, measuring the dip from the horizontal, and observe the angle of inclination of the striations in the plane of the wall, noting which way they are inclined. In some cases the slickensides occur on slips within the vein rather than on the walls of the fissure. There may be also more than one system of striations. Mining men can greatly aid me in this investigation and any information will be gratefully appreciated.

ANDREW C. LAWSON,
Chairman State Earthquake
University of California, Investigation Commission.
Berkeley, California, February 1.

[Mining engineers, geologists, managers, superintendents, miners, and prospectors are urged to aid Professor Lawson in this useful enquiry.—EDITOR.]

The Engineer as a Financier.

The Editor:

Sir—In entering into the discussion you invite on the ethical obligations of the professional mining engineer and his rôle as a financier, I wish to avoid sharing in any confusion that may arise from the use of the word financier in its double meaning, of one skilled in commerce and finance, and of one whose occupation is the obtaining and using of other people's money for the purpose of carrying on operations he recommends as profitable. This latter I will call a promoter, namely, one who finds the ocean and a compass for other people's ships.

We have recently been informed by the president of the American Institute of Mining Engineers that the functions of the mining engineer have expanded because this is an era of expansion. This is a *non sequitur*. Ours is indeed an era of expansion in respect to expanding fields of enterprise, and chiefly so because of enormously increasing knowledge. To be especially useful the individual must content himself with the accumulation, co-ordination, and application of special knowledge concerning only small portions of the entire fields open to enterprise. For the world this is an era of expansion—for the individual it is an era of specialization.

I do not agree with Mr. Hammond that an engineer, having recommended the purchase of a mining property, incurs any moral or other responsibility for its subsequent efficient management, unless he accepts its management; nor do I think he is in any way bound to accept that management. Moreover, though admirably qualified to act as consulting engineer, he may be totally unacceptable as a manager for want of commercial experience and knowledge of organization. It is not a function of the commercial man, or of the promoter to be an engineer; even though this be an era of expansion. A professional man is one who, having special knowledge of a certain field, declares to the world that his vocation is to apply that knowledge to the uses of others and not to his own purposes except as to his fee or stipulated remuneration. Therefore, when the professional engineer offers to his clients his knowledge, services, and advice, his disinterestedness in everything but his fee is implied, and it is upon this guarantee of professional conduct that he invokes the confidence and respect of the public.

He must not only be disinterested and free from bias; but he must not do things that expose him to temptation or permit himself to be brought into situations where his own personal interests will conflict with the interests of his client. The ethics of a profession are not only the few rules of scrupulous conduct that can be written into the governing laws of a professional body, but are also the unwritten general precepts of conduct observed by honorable gentlemen—principles that must be innate or inbred if there is to be any hope of their faithful observance.

The professional man occupies toward his client the position of an employee or agent to a principal. It is, as far as I know, a universal law that that which an employee gains (other than his remuneration) by virtue of his employment belongs to the employer. Any retention of these gains, such as secret commissions, is in some countries a criminal offence and would, if discovered, lead to the imprisonment of the guilty employee or agent; and in all countries, I imagine the dishonest gain could by law be recovered by the proper owner. The acceptance of secret commissions is morally degrading, and if known disgraceful.

The contingent fee has always been abhorrent in the professions, and I would expect that if ever there should be formed in this country an association of mining engineers having a professional basis, one of its canons would be to forbid the vicious contingent fee. For a lawyer to procure his fee out of the money he may be able to collect by a damage suit, or for a professional mining engineer out of the proceeds of the successful sale of a mine, is unprofessional. This is work for the 'outsider'. The disloyal employee who does not serve his employer in good faith, with ordinary care and diligence, and with all the skill he possesses, not only breaks an obligation imposed upon him by law, but atrophies his moral fibre to his own serious injury. I believe that the

making of a report for the seller of a mine is undesirable work for a mining engineer, and that such work should be accepted with caution and precaution. The engineer in such a case should protect himself against the misuse of his reports, and against certain very easy mistakes that can be made in the copying of reports, by which a decimal point may be displaced and $2 assays, for example, may appear as $20, or veins of 2 ft. may be stated as of 20 ft., etc. It is a pity that this work should be undesirable, because intrinsically it would appear to be useful employment for the young engineer. But this is a question, as Mr. Hammond wisely observes, not of professional ethics, but of personal wisdom. I can conceive that a professional society might permit such work if certain precautions could be observed, but I have not been able to think of any that usually would be acceptable to the seller of the mine.

The professions, as an outcome of ancient experience, have formulated certain rules, and have inculcated the strict observance by its members of the highest principles of honor and good faith, for the triple purpose of raising and holding the professions high in public esteem, for the protection of the public, and for the protection of their members in professional relations with each other and with their clients. The private engineer with a single or a few special employers may permit his employers to judge for him whether his associations are dangerous to their interests.

The professional engineer has not the privilege of shifting this responsibility onto the shoulders of his employers, and when he assumes the garb and gown and the dignity and degree, of the professional man, he avows not only that he *is* honorable, but that he will keep himself entirely aloof from allurements that would be considered by worldly people as likely to lead him astray.

LEWIS T. WRIGHT.

San Francisco, January 28.

Tailing-Wheel v. Pump.

The Editor:

Sir—During the past few months several communications have appeared in your journal on the subject of tailing-wheels and pumps, for handling tailing and slime, for both concentrating and cyanide mills. Some of these letters have dealt with the matter at length, but I believe none of the writers has mentioned the proposal made a short time since, on the Witwatersrand, to replace the tailing-wheel by a modification of the air-lift pump.

In 1907 an elaborate series of tests was carried out on a full working scale by Messrs. Henderson and Wilson at the Angelo and Cason cyanide mills, each of 200 stamps. A complete account is given in an article published in *The Engineer* (London) of January 10, 1908. These tests were made, not in the interest of any manufacturer of mining plant, but under the auspices of the company, in the endeavor to find some practicable means of avoiding the use of either tailing-wheels or centrifugal pumps. In raising both slime and sand, the results show a satisfactory degree of economy in consumption of power, and, as the apparatus is extremely simple, with no moving parts, the wear and tear is small. The scouring action of coarse sand, in the air-lift column or delivery-pipe, may readily be prevented by a wooden lining. Moreover, it was found by the engineer in charge of the tests that if the thickness of this lining be varied, being made thickest at the bottom, the roughly tapering cross-section of the delivery-pipe produced a materially higher efficiency than when the pipe was of uniform section throughout. Efficiencies as high as 36% were thus obtained from delivery-pipes measuring 14 in. diam. at the bottom and increasing to 16 in. at the top. I may add that similar efficiencies were secured from tests made in 1906, at Wandsworth, England, on an air-lift pump with tapering delivery-pipe.

ROBERT PEELE.

School of Mines, Columbia University, January 14.

Almarin B. Paul.

The Editor:

Sir—In your issue of January 16 I see a notice, a too brief notice, of Almarin B. Paul, one of the most notable figures in the early mining history of the Pacific Coast, and the inventor of what was long known to us elders as the Washoe process, or the method of treating silver ores by pan-amalgamation, which he introduced on the Comstock Lode. Of his other praiseworthy achievements, and of his operations as a miner, concerning which I have little personal knowledge, I say nothing now. But to his very great usefulness as a millman, his readiness to investigate any promising improvement, and to accept it when found good, his honesty and his generosity, I bear willing testimony—all the more readily because he always seemed to me rather modest in claiming credit to which he was justly entitled.

So far back as I can remember—indeed from the very foundation of this journal, I have reason to believe—there was no more welcome visitor to the office of the MINING AND SCIENTIFIC PRESS, to which his alertness, his cheery enthusiasms, and his quiet humor, always brought pleasant light and warmth. Many years have passed since I last met him. Now that he has gone, I wish to say that I am glad that I once knew him, and that I shall ever hold him in loving remembrance.

A. D. HODGES, JR.

Boston, January 27.

Thawing Powder.

The Editor:

Sir—It is not known to the writer whether the system of thawing powder with hot air is in use or not, and I submit this sketch of a device that has passed through the experimental stage into an efficient and satisfactory thawer. Anyone who has developed a mine from a prospect to a producer, especially in a new district, where communication with a base of supplies is both seldom and difficult, has encountered obstacles requiring efficient and speedy

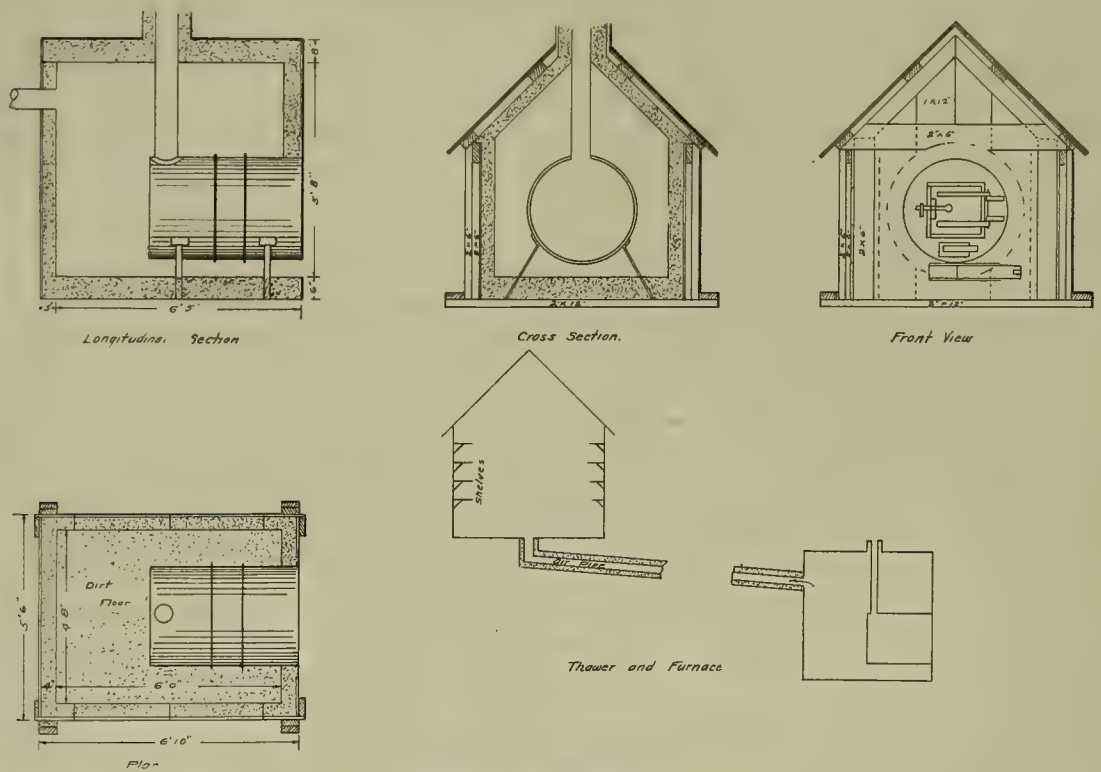
action. This thawer is the product of such circumstances. I have had experience with both steam and hot-water thawers, and it is my opinion that this hot-air thawer eclipses both, by eliminating danger from ignition and explosion of combustibles, and cost of installation, and it equals, if not surpasses, them in economy of operation.

This sketch is from the original drawing. The interior lining, which holds the earth-filling in place, is corrugated iron roofing, held in position by ¾-in. iron pipe nipples, 4 in. long, placed between the iron and board structure with bolts through the nipple. The stove is made from a gasoline tank. The fuel is green hemlock and spruce.

It requires no attention, other than an occasional firing up and regulation of the drafts. Twice the heat got so intense as to ignite the wooden supports of the roof, even through the earth-filling, being conducted by the bolts. These supports have been replaced by 8-lb. T rails and covered with corrugated iron roofing. The pipe from the furnace to the thawer is 6-in. iron, also encased to prevent loss by radiation. The floor of the thawer is approximately 6 ft. above the outlet of the furnace, and about 40 ft. distant. These distances should no doubt be greater for both efficiency and safety. A thermometer has not reached us yet, but a temperature of 100° F., I should think, could be readily obtained in the thawer—much higher, of course, than necessary. The thawer is a board building, 8 by 10 ft., and the air-pipe enters through the centre of the floor. It is giving excellent satisfaction.

W. P. Rogers.

Goose Bay, B. C., December 18.



Apparatus for Thawing Dyanamite.

Electricity as an Aid in Amalgamation.

The Editor:

Sir—In your issue of January 9 appears an article giving directions for the amalgamation of new copper plates, when they have not been previously silver-plated by the standard method. The writer points out some of the difficulties that attend the 'breaking in' of a new mill-plate. I wish briefly to indicate a simple method by which not only the difficulties mentioned may be avoided, but all the usual troubles of the amalgamator obviated. By this simple process, which only requires in the way of additional equipment an inexpensive 2½-hp. low-voltage generator, new copper plates can be prepared for use in 30 minutes; the amalgam surface is phenomenally bright and active; fouling is impossible, and the amalgam, while soft and plastic, is tough, tenacious, and is not broken off or carried away.

To equip the usual mill-plate so that the wonderful properties of electro-chemical action can be used in connection with standard amalgamation, longitudinal or transverse strips of graphite, a few inches apart, are suspended about ⅜ in. above the plate; the graphite strips (anodes) are connected to a 5 to 10 volt generator of sufficient size to furnish about one ampere per square foot of plate-surface; the plate (cathode) is also connected with the generator; sufficient water is used to make a connection between the graphite strips and the plate. This is all the special equipment required, and adds practically no additional operating cost. In preparing a new plate, the surface is cleaned with vinegar, the water and current turned on, and a weak solution of bichloride of mercury fed into the water before it reaches the

plate. In 30 minutes the plate will be covered with a beautiful coating of nascent mercury, which will hold any kind of gold passing over it, be the gold rusty, greasy, coated, silicious, arsenical, or what not; the finest particles of gold in slime are held as readily as the larger particles, and as long as the electric current is passing no more amalgamating troubles will occur. The pulp is then passed over the plate in the usual manner, but extra water can be employed without detriment.

Quicksilver can be used in the usual way, or it may be supplied in the form of a solution; the action of the electric current cleans the gold and destroys organic matter and impurities. Under electro-chemical action, the amalgamating power of mercury is made much stronger than normal; with such an equipment as above outlined, gold can be amalgamated which would otherwise pass readily over the usual plate. I have found by numerous tests that with electrolytic amalgamation the tailing-asays are greatly reduced. I might add that all the statements made in this communication are not based on guesswork or theory, but are the result of a long series of tests with a plate-surface 30 in. wide and 32 ft. long, and confirm statements made by Warnford Lock in 1892.

So far as I know, the first authoritative statement regarding the great value of electro-chemical amalgamation appears in the Proceedings of the London Institution of Mining and Metallurgy, Vol. I, page 205, where appears a paper by C. G. Warnford Lock, in which he gives the results of many trials showing how electro-chemical action greatly increased the amalgamating action, and those who wish to investigate the matter are referred to Mr. Lock's paper. Not only have Mr. Lock's statements been amply substantiated, but even more wonderful results have been achieved.

ELMER ELLSWORTH CAREY.

San Jose, California, January 16.

Mining Law in Nevada.

The Editor:

Sir—The editorial in your issue of December 26, headed 'Mining Law in Alaska', was, as your articles usually are, very much to the point. That the same evils exist in all of our mining regions, especially during boom times, no one familiar with the conditions will dispute, and all but the professional stampeders would like to see the law so changed as effectively to prevent speculators from tying up large areas of mineral land and keeping them for long periods withdrawn from entry by prospectors. I have so often had the irritating experience of finding miles of such ground held by the most perfunctory compliance with the laws—being practically certain that not one legal discovery had ever been made on any of the claims—that I am naturally very much pleased at the strong stand you take against existing abuses, and would also like to add a few remarks on the subject.

As you say, the chief value of the existing laws is in the security of title afforded by them. This security extends to everyone who initiates a title by going through the form of posting a location notice and marking the boundaries of his claim, the presumption being, as I believe the courts have ruled, that a discovery has been made. If no such discovery was made, the entry consequently being fraudulent, the law nevertheless protects the locator in his fraud by throwing the burden of proof on those attacking his title. This is only in accordance with the fundamental principals of all our laws, which are said to abhor a forfeiture. The trouble is that it is impossible strictly to define what a discovey consists of. Assay-values of the minerals present in the rock, or the absence of such values, are no true criterion. But if a locator were to go into possession, as you suggest, and work the ground continuously for, let us say, one or two months, that might be taken as strong presumptive evidence that he had found something worth while. If the law required such an entry to be made, instead of the mere assertion of a discovery, as part of the first step toward the acquisition of a possessory title from the Government, the speculator in mining locations would be severely handicapped, and the bona fide prospector, as well as the mining industry in general, immensely benefited.

The great defect of the annual labor clause, probably, is the requirement that a specified amount of money be expended. It is absolutely impossible to judge the real expenditure by the evidence of the work performed, and therefore those disposed to evade the law feel quite safe to do so, and perhaps hire the work done at bargain-counter prices, with a 'proof of labor' for the whole $100 worth thrown in. I regret that I cannot agree with you in expecting an abatement of this evil coming through an increase in the law-abiding element of the mining regions—at least not until the tax-dodger of the land and all his tribe have become extinct. "Everybody else does it, why not I?" is the ancient and world-wide motto of applied sophistry. In the days before the Klondike excitement, when Miner's Law was recognized on the Yukon, the owner of a claim was required to 'represent it', that is, to remain on the ground and work it during a certain month of each year, either in person or by employing someone else for the purpose. It was extremely difficult to evade that law. If a modification of it were adopted here, or if the United States requirements were a specified number of days work for each claim, instead of the expenditure of $100, it would probably reduce the extent of existing abuses.

ANTHONY ELFFNER.

Rosebud, Nevada, January 3.

In nine cases out of ten, when timbers are crushed, the indirect cause is decay, produced by low forms of plant life. The dwindling of the timber supply has driven consumers all over the country to study the prevention of decay, and in the near future many mines will put in small plants for the treatment of timbers, after the pattern of the plants that have been designed and installed for this purpose by the United States Forest Service. By treating permanent timbers with one of the various preservatives, they may be made to resist decay almost indefinitely, at slight cost.

MINING IN SIBERIA.

Written for the MINING AND SCIENTIFIC PRESS
By CHESTER W. PURINGTON.

In eastern Russia gold mining has been in progress for 150 years. In the Tomsk, Transbaikal, Yenesei, and Altai districts operations have been continued for over 60 years.

The product has been mostly from alluvial washing. Up to 1897 the recorded yield was 216,000 poods, since which time it has averaged 2000 poods per year. Taking the gold at a conservative value of 850 fine, the gross recorded gold product has been approximately two billions of dollars. The Lena district alone, an area comparable in size and to some extent in physical conditions to the Fairbanks region of Alaska, has produced $250,000,000 in 56 years. This district is by no means fully explored.

The foreign engineer or operator meets many strange conditions in Siberia. In the first place, the physical conditions are unusual for a mining region. The richer mining districts are situated remote from the main trunk line of railway crossing Siberia and Manchuria. Distances varying from 10 to 500 and even 1000 miles must be traversed in rough carts over execrable roads, or, where water transportation is available, by means of indifferent steamboats, in order to reach the gold mining camps from the railway.

There are few places where the grades of streams are sufficient for generating power from falling water, and room for the tailing must be artificially provided. By far the greater portion of the vast gold-bearing area is characterized by shallow alluvial deposits, consisting of three to four feet of pay-gravel capped by 10 ft. or more of nearly barren overburden. The frozen alluvium of the Bodaibo, and neighboring streams of the Lena districts, presents a remarkable exception, being from 50 to 150 ft. deep. This district is characterized by perpetual frost in the gravel and is worked largely by driving. The solid 'frost' of the Klondike and Fairbanks is rare in Siberian gravels, which are either entirely free from perpetual frost or are only partly frozen, as in the Alaska Forty-Mile district.

The gravel of the pay-channels in Siberia generally is sub-angular rather than round, so that it does not roll easily in sluices or other washing devices. It is also mixed with clay. These features tend to reduce the capacity of washing-plants.

The most remarkable feature of the Siberian gold-fields is physiographic uniformity, thus rendering it possible for general statements like the above to be made regarding an area covering more degrees of longitude than intervene between New York and Bering strait. In an area that exceeds 5,000,000 square miles and which extends from 43 to 78° north latitude, it is to be expected that there should be extreme climatic variations. Such is the case. In the Ussuri valley, north of Vladivostok, two crops of grain per season are possible. At Habarovsk, which is under the latitude of Seattle, Indian corn flourishes. In June 1907 my wife planted a kitchen garden, at our property, ten miles from the shore of the Okhotsk Sea, and in three weeks we were eating radishes and lettuce therefrom. In south Siberia camels are used for transportation. North of the 54th parallel, dogs and reindeer are used in winter.

Roads are always abominable in the summer time. Both freight and passenger transportation off the main line is slow and poor, but not expensive. Wood for fuel is plenty and cheap, rarely exceeding $1.50 per cord except in the most remote camps. Timber is good on the hills, but fit for nothing but firewood when cut in the immense bogs and valleys that characterize the country. In parts of the Ural the supply of wood for charcoal-burning has been exhausted, and peat is used. It is the only fuel employed at present on the dredges operated by the Neviansk Company.

The labor conditions are such that a rapid increase in mineral production is not to be expected. Russian peasants are fairly successful in agricultural pursuits, but not in mining. The old style of Siberian gold-miner has been accustomed to hand-shoveling, and generally figures his product for the season in terms of the number of men and horses he proposes to employ, as for example, 500 men and 60 horses, 1000 men and 200 horses, and so forth. The progressive exhaustion of the former rich alluvials naturally interferes with this convenient method of calculating assets, and the Siberian has turned to the gold-dredge as a last resort. As yet the dredges installed have been of faulty construction and low capacity, and the results insignificant.

Siberia has never been known as a gold-quartz mining country. Parts of the Altai promise well for prospecting, and there are several small crushing mills at work in the region between Minusinsk and Kuznetsk. The lodes are fairly wide, but the ore is spotty.

A 5-stamp mill is at work, or was, last summer, at Askold island in Vladivostok harbor. The ore comes from a four-inch vein in granite and has to be sorted as mined. It contains much copper and iron pyrite, and is rather difficult to treat. It is said to be rich in gold. The mill was built by the Union Iron Works of San Francisco, and was furnished with Wilfley tables. An experimental attempt was being made to chlorinate the concentrate. According to Government figures, the mine has been operating several years and has produced over $100,000. The cost of mining, sorting, and milling the ore was given as $7.50 per ton.

A 10-stamp mill with concentrators was ordered a year ago from Fraser & Chalmers for a quartz mine at the head of the Selinga river, 500 miles northeast of Blagovestchensk-on-Amur. As a comment on Siberian transportation, it may be said that although the mill left England last April, going by Suez to Nikolaievsk, it will be the end of this winter before it is landed on the property. This was the quickest transport possible from London. Quartz veins exist near Nerchinsk and have been considerably developed.

The copper resources of the Kirghiz steppes of west Siberia have recently been developed to some

extent by foreign companies. The outcrops of the deposits are said to stretch over a wide area. There are also promising deposits in the north Ural, but the product has always been small. Platinum is now being dredged from several river beds in the northern Ural, and it is likely that more deposits exist still farther north than those exploited. The extreme north Ural affords an interesting field for study, as the geological conditions are similar to those upon the Shuvalof property, whence the larger amount of the platinum comes at present.

An attempt has recently been made by a German company to open some of the old silver-lead deposits of the Altai. The veins are undoubtedly large, and are said to have been proved to over 1000 ft. in depth. So far no considerable product has been reported.

Probably one reason why all forms of quartz mining in Siberia result in small output is the paternal character of the mining regulations relating to timbering, placing of machinery, and use of explosives. The laws are evidently intended to protect employees, but if strictly enforced would practically shut-down all underground work. An entire revision of the mining law so as to render it compatible with up-to-date methods would be a benefit. The laws are too liberal in some ways and too restrictive in others.

The difficulty of language will always be a hindrance to the development of Siberia by foreigners. English is spoken little even in the towns, and with the exception of the east coast, where English-speaking Chinese can be secured, all instructions to laborers must be given through interpreters.

The shortness of season is a drawback to Siberian gold-dredging; gravel from which only 15 cents per cubic yard can be recovered does not pay, as it does, for example, in California. Gravel of higher tenor than this, however, occurs in several of the river valleys which have been prospected in east Siberia, especially the tributaries of the Amur. Accessory dredging conditions are favorable rather than otherwise. At the Neviansk property in Ural experiments are tending to a lengthening of the dredging season. Mr. Barbot de Marny is authority for the statement that one Neviansk dredge in 1905 worked 248 days between March 10 to December 22. In 1906-7 the Neviansk season lasted from April 13 to January 31. The conclusions reached from several years' operations of five dredges were that the cost of work after ice forms is 30% higher than before; that the loss of time is 7% greater; and that the loss of gold is increased through freezing of the tables.

No attempt has been made up to the present to attack frozen gravel with dredges. If the gold-dredge reaches a stage of development such that frozen gravel can be successfully handled the shallower deposits of the Olekma and Vitim districts can probably be worked by this method.

Interesting developments are anticipated, now that English capital has become interested in the deep gravel-leads of the Bodaibo and adjacent creeks. Improved steam-thawing methods and systematic drift-mining should progressively decrease the cost of mining and increase the output.

PUMP SLUICING FOR GOLD.

By H. Herman.

*This method is almost wholly restricted to the winning of the two metals whose wide distribution in detrital form is one of their leading characteristics, namely, gold and tin, the latter, of course, in the form of tin oxide. Pump-sluicing will not solve the problem of working at a profit the deep leads of the Berry-Moolort-Loddon system, which yield about 10 dwt. per square fathom of wash-dirt, because the wash-dirt is overlaid by 300 to 400 ft. of clay and basalt-flows, which render any system but that of the deep alluvial miner out of the question. But if 3 ft. in thickness of wash-dirt be overlaid by only 50 or 60 ft. of material readily disintegrable under a jet of water issuing from a nozzle at a pressure of 50 or 60 lb. per square inch, it may be cheaper to remove the 60 ft. by sluicing than the 3 ft. by alluvial mining, with the additional advantage that the valuable mineral which often occurs in the 'overburden' in such deposits is largely extracted also. Some detrital deposits contain gold or tin throughout the whole or the greater part of their depth, and in such cases it may pay handsomely to sluice to a depth of 100 or 150 ft., where mining the bottom only would cause disastrous failure. In every case of doubt the nature of the whole deposit and the distribution of the metal should, as far as possible, be ascertained before adopting any fundamental scheme of treatment.

Pump-sluicing and bucket-dredging each has its characteristic field of usefulness, and in many cases it is easy to decide that one or the other is the only practicable method. An engineer would not suggest pump-sluicing the beds of the fast-running streams of New Zealand, where bucket-dredge mining first found a home; neither would he place a bucket-dredge on a deposit 100 ft. thick, nor on a deposit one-fourth that thickness if a few feet of valuable 'wash' lay between a hard uneven bottom below and a tough bouldery overburden above. In such cases the proposition is either adopted or rejected after consideration of the one practicable method. Numerous cases arise, however, where either method is practicable, and upon the choosing of the right one may depend the success of the venture. If the question be simply how to turn over 20 to 30 ft. of non-tenacious material at the lowest cost, in sporting parlance, assuming a sufficient water-supply, 'only one horse is in the running', namely, the bucket-dredge. In Victoria in 1907 about 10,000,000 cu. yd. of material was treated by bucket-dredges, and about 10,000,000 cu. yd. by pump-sluicing plants: the average cost per yard in the former case was under 3d., and in the latter over 10d. The reasons for such a marked difference in costs are not far to seek. First, assuming ground of equal depth and tenacity, say 20 ft., the principal work of a bucket-dredge would be to break up the face with grabs or buckets, lift the solid material in the chain of buckets a height of 40 to 50 ft. (of which 15 ft. would be assisted by

*Abstracted from *The Australian Mining Standard.*

displacement of the water in which the pontoon floats), and elevate with a centrifugal pump to the sluice-boxes 2500 to 3000 gal. per minute of sluicing water against a head of 25 ft. A pump-sluicing plant of the same capacity would have to deliver probably 3000 to 3500 gal. or more of water to a nozzle under an equivalent head of 100 to 150 ft., then raise the same water, as well as perhaps a considerable quantity of water draining from the deposit, together with the comparatively small weight of solid material sluiced, to a height of 40 to 50 ft. These figures explain why it is that a pump-sluicing plant usually requires five or six times the engine and boiler-power of a bucket-dredging plant of the same capacity. Flooding paddocks for shifting plant and building tailing dams are further serious items of 'dead work' not having a corresponding offset in the practically continuous run of a bucket-dredge. The above comparison in Victorian costs in favor of the latter is, however, rather unfair to pump-sluicing, by reason of the fact that in addition to treating ground of greater average depth (approximately 20 ft. against 15 ft.), the pump-sluicing plant had to take all the tough irregular ground that the bucket-dredge could not attack. Conditions, however, being equal, the relative yardage-costs would probably still be 2½ or 3 to 1.

With such a striking disparity in costs, it is apparent that some weighty reasons should be forthcoming before rejecting a bucket-dredge in favor of a pump-sluicing plant; unfortunately, such reasons are frequently not wanting. The bucket-dredge, for successful working, requires fairly easy breaking ground and moderate depth. If the values be on or close to the bottom, such bottom must either be very even or soft enough to dredge evenly. Sufficient water-supply must be available to maintain floating water, the drainage-loss through loose tailing often being large. A bucket-dredge placed on unsuitable ground may suffer frequent stoppages and breakages, heavy maintenance charges, small turn-over, and a recovery of less than one-half of the gold or tin; then pump-sluicing, which is adaptable to changing ground, and permits of full inspection and clean-up of the bottom, may furnish better commercial results, despite higher costs.

This article, having for its object merely the setting forth for the benefit of laymen the chief considerations in the selection of a plant for the treatment of detrital deposits, technicalities have been avoided. It may be well to point out, however, that even after a selection of a general method has been made, the greatest care is necessary to work out details along right lines. What shall be its capacity or yardage? Where obtain a water-supply? Where draw the right line between large capacity, high capital expenditure, and low working costs on the one side, and smaller capacity, lower capital expenditure, and higher working costs on the other? What sort of a pump-sluicing plant shall be provided? A number of tin-sluicing plants in New South Wales consist of two portable engines, side by side on the ground, working nozzle and gravel-pumps respectively, and when the limit of operations from one position has been reached, land transportation is necessary to the next location. Such plants are owned by the Tingha Tin Dredging, Union Tin Dredging, Ferris, and Stannum companies. One plant of the Elsmore Co. pumps water 240 ft. high to a reservoir, and thence takes nozzle pressure by gravitation, sufficient fall being available for this purpose, as also to get rid of tailing by ground sluicing. The Bourke's hill mine has for some time worked two ground or stationary plants; recently, with altering conditions, it has been deemed advisable to place one plant on a larger pontoon. The Briseis Extended Co., in Tasmania, lifts its wash through a 16-in. pump over 120 ft. in one lift; the Pioneer Co., in the same State, prefers to divide about the same elevation into two lifts, using three plants on pontoons in its operations. The latter company also, having a good water-supply under pressure, needs to employ steam for gravel-pumps only, and is now well under way with a hydro-electric installation which will obviate the use of steam altogether. The South Mount Cameron mine, Tasmania, resembles the Elsmore, except that the permanent pumping plant sends water under pressure direct to the nozzle, instead of using an intermediary dam. The bulk of pump-sluicing plants, however, consist of both nozzle and gravel pumps, worked by steam, and erected on a pontoon for water transportation to a new site after the excavation of each paddock. While the range from the 10-in. gravel pump and 150 to 200 effective horse-power of the 'Standard' plant of the Castlemaine district to the 16-in. pumps, with four times the power, of plants like the Y-Water at Emmaville, New South Wales, and the No. 2 Creek at Avoca, Victoria, give the engineer small scope for consideration before making final recommendations involving matters of capacity, first cost, and working expenses. Probably the most powerful pump-sluicing plant yet constructed is on its way to Billiton, in the Dutch East Indies, from the yards of a Melbourne engineering firm. This plant will carry over 1000 hp. on a steel pontoon 70 by 35 by 6 ft., drawing 5 ft. of water, and independent vertical compound condensing engines of 375 and 760 hp., respectively, and will drive a 16-in. nozzle-pump and a 16-in. gravel-pump, the latter lifting its burden to a maximum height of 120 feet.

Peru produced 207,810,365 kilograms of silver in 1907. The principal producing departments were Junín, yielding 108,026,229 kg.; Lima, 32,941,773 kg.; Ancachs, 25,620,948 kg.; Cajamarca, 13,731,639 kg.; and Huánuco, 10,446,446 kg. The larger amount of this production, reaching 42,517,948 kg., was in the form of argentiferous matte.

Sulphur is found in buried marine sands on the coast of the Department of Piura, Peru, near the town of Sechura. During 1907 La Compañía Azufrera Sechura produced 80 tons refined sulphur in the form of 'flowers of sulphur', grain, and rosín, and 4500 tons of crude ore containing by assay 1800 tons of sulphur, or 40 per cent.

JALISCO AND COLIMA.

Written for the MINING AND SCIENTIFIC PRESS
By W. A. SCOTT.

Extensive grain-raising areas exist in Jalisco, and the general aspect of the region is prosperous as regards agriculture, as well as mining. The country is fairly well watered by the Rio Santiago and its tributary streams and head-water lakes; and by the Ameca, Tuxpán, and Armeria. The Santiago, which drains the country from Lake Chapala northwesterly, including Etzatlán and Hostotipaquillo, flows through the territory of Tepíc, and empties into the Pacific near San Blas. It is considered the greatest river in Mexico, as regards the volume of water it carries, though other streams have greater length. The route of the Southern Pacific branch railway, as laid out between Mazatlán and Guadalajara, crosses the Santiago 15 miles east of San Blas, and thence takes a southeasterly course through Tepíc, Ixtlán, Tequesquite, Tequila, and Orendain, the last being the junction point of the new road with the Mexican Central branch from Guadalajara to Ameca. This route, while it may be said to pass up the Santiago river, keeps from 12 to 25 miles away from the stream. The mines of the Hostotipaquillo district, including the Casados, El Favor, Mololoa, Virginia, and Mexico, Mina Grande, and Cinco Minas, are situated between the railroad and the river, extending as a chain from northwest to southeast. Tequesquite station, on the new road, is within 10 to 20 miles of the mines of the district, whereas Etzatlán, the present nearest forwarding station on the Mexican Central, is 40 to 50 miles distant. The railroad is practically finished from Orendain to Tequila, a distance of about 35 miles, and the further extension of 20 miles to Tequesquite will give the mine-operators of the Hostotipaquillo district better transportation facilities in the near future. Between Tepíc and Tequesquite is where the greatest engineering and most expensive work will be required, as part of the route between those places is over mountains and across deep canyons. That part of the road from Culiacán to Mazatlán is nearly finished, and it is reported that train service will be commenced on that division before March 1.

Guadalajara is one of the best built cities of Mexico, and its prospective connection with the Southern Pacific coast-line railroad, and the recent connection with Manzanillo by the completion last month of the Mexican Central's Tuxpán-Colima division, give to the city an auspicious future as a commercial and railway centre. Viewing the cultivated valleys and plains of Jalisco, the observer notes the absence of the maguey plant; instead are fields of corn and other cereals, along with orchards, and groves of eucalyptus trees, all suggesting better industrial conditions. The length of the railroad from Guadalajara to Manzanillo is 230 miles. That part from Guadalajara to Tuxpán extends through the productive Sayula valley, thence over a divide to that of the Tuxpán. Here the traveler obtains the first sight of the active volcano of Colima, which continues in plain view till the train passes far to the south of the town of the same name. The route from Tuxpán to Colima is down the Tuxpán river, which flows in a deep canyon a large part of the way. In following this course the train passes through 13 tunnels, all arched with concrete blocks; it also crosses 15 steel bridges, one of which spans the main stream, the others spanning in-coming branches. Before reaching Colima the road leaves the Tuxpán valley, and



Manzanillo.

crosses a divide into the country drained by the Colima and Armeria rivers. From this side is obtained the most advantageous view of the volcano, a gray cone-shaped peak, rising to an altitude of 14,360 ft. above the sea. Early in the morning on passing here the writer saw the smoke and gas emitted from the crater ascending almost vertically 50 to 100 ft., and gradually drifting away as a cloud in the sky. In appearance this column of smoke and fume resembled that rising from the stack of a smelter, except that the volume from the crater seemed many times greater than that being emitted from any chimney. At mid-day the atmosphere must have become more moist, as the smoke no longer ascended, but settled about the crater and hid from view the apex of the mountain. In the vicinity of Mount Colima is a similar peak, having an extinct crater. Colima, the capital of the State of that name, is an attractive place, with well-kept streets and plazas, adorned by the tropical verdure pertaining to this district. From here the train runs to Manzanillo in 5 hours,



Part of Jalisco, Mexico.

passing through the plain and the valley of the Armeria river, with banana fields, cocoa-nut groves, and spreading palms. Along the route are seen the steep thatched roofs of the huts and houses of the inhabitants, reminding one that during the long rainy season the roof is the most essential part of the dwelling. Manzanillo is a good natural port at the head of a small bay which extends inland three miles from the open sea. Protecting the landing is a 200-ft. breakwater, recently finished by the Mexican Government. The surrounding hills are uneven, rolling, and covered with bushes and scrubby timber. The railroad leads through a cut made in the low hills, the track then extending 20 miles down the coast upon a peninsula separated from the mainland by a lagoon of equal length. Here the lagoon is crossed to the mainland. The coast steamships that call at the port of Manzanillo belong to the Pacific Mail line, the Kosmos, Canadian-Mexican, and Mexico National. A large German vessel which recently landed at this port with a cargo of railroad ties from Japan for the Southern Pacific Co. will now ply regularly between Seattle and Central American ports, and compete for the freight and passenger traffic of the coast towns.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination.

M. W. J., Fairview, Nevada: Gypsum.

C. R. H., Hermosillo, Mexico: Wollastonite.

J. J. M., Oat Hill, California: An earth rich in limonite.

C. W. L., Salt Lake City: Mottled quartzite with pyrite and pyrrhotite.

R. C. K., Yerington, Nevada: Crystalline limestone stained with malachite.

M. J. O'C., Denio, Oregon: Material is opal, some of it of the variety known as precious opal.

F. J. J., Millett, Nevada: A garnet-epidote-calcite rock, the product of contact metamorphism, originally a lime bearing sediment.

E. D., Salt Lake City: No. 1, quartz-calcite-epidote rock, a metamorphosed sediment; No. 2, aplite; No. 3, rock intermediate in texture between granite porphyry and rhyolite; No. 4, gabbro.

L. H. G., Los Angeles: No. 1, granite-porphyry or rhyolite-porphyry, possibly syenite-porphyry; No. 2, metamorphic rhyolite; No. 3, weathered rhyolite; No. 4, rock is shale, white coating is very thin and seems to be kaolin but it cannot be isolated for precise determination from the rock in which kaolin is present in large amount.

J. J. M., Reno, Nevada: No. 1, garnet-chlorite (vesuvianite?) rock, a product of contact metamorphism, containing small quantities of pyrite and molybdenite; No. 2, crystalline limestone; No. 3, badly weathered quartz-feldspar-mica rock with much limonite and some calcite. The surviving texture is nondescript, so that it cannot be determined whether the rock is granite or arkose without microscopic study; No. 4, peridotite, much serpentinized; No. 5, quartz-chlorite schist; No. 6, granitite.

W. D. McP., Santa Cruz Mtn., California: No. 23, powder from drilling; no definite determination could be made; the powder seems like that of a basic volcanic rock somewhat metamorphosed; No. 24, well developed pyrite crystals and massive pyrite in a much sheared and brecciated rock in which calcite and quartz veins are seen, with some serpentine and chlorite; no definite name can be given to such an aggregate; No. 25, small amount of pyrite and calcite in a rock crushed and sheared beyond definite recognition; some serpentine is present; it appears like a metamorphosed basic volcanic; No. 26, silicified basic volcanic breccia; No. 27, serpentinized and silicified basic volcanic rock.

THE GRANBY SMELTER.

By Robert Keffer.

*At Grand Forks, British Columbia, in the narrow valley of the North Fork of the Kettle river, a short distance north of the main town, is situated the smelting plant of the Granby Consolidated Mining, Smelting & Power Co., Ltd., the largest copper smelter in Canada. The position is such that the prevailing winds carry the sulphur fume through a ravine to the east, or else up the valley of the North Fork; thus the air at Grand Forks is exceptionally good for a smelter town. South and east of the town are extensive orchards, where choice apples and other fruits are grown, quite unaffected by the proximity of the big plant. The smelter-site is well above the river, giving a large slag-dump with a minimum amount of haulage. A dam across a narrow part of the valley, a short distance above the plant, forms an artificial lake of generous proportions, storing water for all purposes during the season of low water, which is in the winter. Sufficient fall is obtained to operate an electric generating plant.

The first furnace was blown in on August 21, 1900, at which time the plant consisted of two furnaces, having a joint capacity of between 600 and 650 tons daily. This was the first plant to smelt ores from the 'Boundary.' It had been built on the theory that the raw ore would give a low-grade matte on the first smelting, and would require re-smelting to bring the matte up to shipping grade of about 60%. But it was soon demonstrated that the ore would yield a sufficiently rich matte with the first smelting, and both furnaces were thereafter used for treating ore direct, thus immediately doubling the supposed capacity of the plant. For several years the final product was matte, which was sent east for further treatment. A converter was then installed, effecting a large saving in freight and in converter charges. The smelter capacity has been continually increased, until today it averages between 3000 and 3200 tons daily, with eight 44 by 210-in. furnaces in blast. The best week's run yet made was 24,000 tons in seven days, being an average of 3425 tons every 24 hours. Since the plant has been in operation, a total of 4,761,657 tons has been reduced up to December 1, 1908. The greater part of this tonnage has been taken from the Granby company's mines in Phoenix, the rest being custom ore from various adjacent camps.

The principal mining properties of the Granby Consolidated Co. are situated at Phoenix, about 15 miles distant in an air-line, and 25 by railway from the smelter. The elevation of the mines is 5200 ft., 3000 ft. above the smelter. Two railway systems, the Canadian Pacific and the Great Northern, have lines connecting Grand Forks and Phoenix. About eighty 50-ton and eighty 40-ton ore-cars, and six 150-ton locomotives, are employed by these roads in hauling Granby ore from the mines to the treatment plant. The Phoenix mines comprise a group of claims, among which the most important are the Old Ironsides, Knob Hill, Victoria, Monarch, and Gold Drop, the total area exceeding one thousand acres. The ore, which occurs in deposits of great size, is mined in immense stopes, in which practically no timber is used, the ore standing quite firmly. This system reduces mining costs to an extremely low figure, and is one of the circumstances making possible the handling of the extremely low-grade ores commonly found in this district. The Boundary ores are practically self-fluxing, the occasional addition of a small quantity of heavy sulphide being all that is necessary for a perfect smelting mixture. The proportion of coke used is 12½%. The coke comes from the mines of the Crow's Nest Pass Coal Co., at Fernie, B. C. The ore on reaching the smelter is dumped from hopper-bottom steel ore-cars into the main receiving bins, which are reached by the tracks of both railways. The bin structure is divided into five rows, with a total width of 75 and a length of 764 ft. Over the entire length of each row of bins extends a railway track, so that every bin may be filled direct from the railway cars. Three rows of bins are used for ore and two for coke. The ore-bins are divided into compartments 13 ft. long, having hopper bottoms sloping toward the chutes at an angle of 45°, so that they can be completely emptied without shoveling. There are 150 of these compartments, with a total capacity of 15,000 tons. The coke bins are not divided into compartments, and are flat bottomed. Railway scales are provided for all tracks, on which the ore is weighed before going to the bins. Under the bins, 6 ft. below the chutes, run three 20-in. gauge tracks, on which the feed trains operate, each inner track serving two rows of bins, and the outer track serving one row. The feed trains consist of three large cars, of a total capacity of four tons of ore, plus the requisite amount of coke. These cars are drawn by a 30-hp. electric locomotive, and are filled from chutes operated by a lever, from an elevated platform provided for the purpose. Coke and ore are mixed in the proper proportion directly in the charging car, the coke being placed in the bottom, and the cars weighed, after which the ore is added. This done, the charge is weighed a second time and run to the furnaces. Each train of cars feeds two blast-furnaces, and handles 750 to 900 tons of ore in 24 hr. One car in every ten of the Granby ore, and all of the custom ore, is run through the sample mill, the remainder going direct to the furnaces. The Granby ore is crushed to between 4 and 6 in. at the mines.

The feed cars have a raised bottom like an inverted V, and dump from both sides. Two sets of wheels are provided, one of narrow gauge for the loading tracks, and one of a gauge of 65 in. After receiving the charge, the feed trains go into the furnace room, the cars always being in front of the motor. The cars are run directly inside the upper part of the furnace, being supported upon entering the furnace by the wide-gauge wheels, which here run on tracks on the sides of the furnace. The three feed cars are of sufficient length to fill the furnace from end to

*A student contribution to the Mining Engineering Society at the State College of Washington.



Converter Room, Granby Smelter.



Pouring Blister Copper, Granby Smelter.

end, and upon reaching the proper position are dumped by means of a lever operated from either end of the furnace. The ore and coke is well distributed over the furnace by this method.

Two stacks are provided to dispose of the fume from the battery of 8 furnaces, one stack being at each end of the plant. These are connected with the down-take pipes by brick dust-chambers of large dimensions. The flue-dust, which carries about 1½% copper, is briquetted and smelted. On the furnace floor, the slag and matte run into a settler placed at the front end of each furnace. From this, the slag runs into a second settler, with a slag-spout on each side. Two slag tracks are provided for each furnace. The track on the left of the settler is on a considerable grade and runs further back than the right-hand track. This arrangement provides for two slag-pots on one side of the settler, and one on the other side. When one of the left-hand pots is filled, the brakes are released and the second pot is run under the spout by gravity. As soon as both pots on the long track are filled they are hauled away to the dump, the slag stream meanwhile being diverted to the right-hand pot. The slag is removed from the furnaces by 14-ton steam locomotives, of which there are four; one for each two furnaces. One locomotive, and between 10 and 12 slag-cars are constantly kept in reserve for use in emergency. An ingenious arrangement is used to dump these slag-cars. The slag-bowl rests on a toothed wheel at each end, and is so mounted that when filled the centre of gravity is above the centre of equilibrium. A catch being released, the pot is automatically tipped. When empty, the centre of gravity is altered, so that the pot returns by itself to its original position. The matte is tapped into a 3-ton cast-steel pot, placed on the right of the settler. A crane traveling the length of the furnace room carries these pots, when filled, to the converter room, and replaces the empty pots. When the pot containing the molten matte reaches the converter room, it is taken in charge by a 40-ton Niles crane running the length of the room, and is dumped into the converter to be blown to blister copper. There are at present three converter stands, but this equipment is becoming inadequate, and the converter room is being doubled in size, three additional stands being installed. The converters are lined with a mixture of clay and highly silicious ore, the lining being done by the usual automatic tamping device operated by compressed air. Each lining is used several times. When conversion is complete, the copper (blister) is poured into moulds running on a track directly beneath the converter, and cast into bars. The blister copper, carrying from 98 to 99% copper, is shipped to New Jersey for electrolytic refining.

The converter slag is poured off 3 or 4 times during the conversion of a charge. This slag is poured into a large pot, which is placed on an automatic pouring device. This gradually empties the slag into the buckets of a slowly ascending elevator that pass under a stream of water, cooling the molten slag, and hardening it sufficiently to allow of dumping it into a bin. The converter slag contains a large amount of copper, and goes back to the furnaces. Electric power is used throughout the entire plant, most of which comes from the West Kootenay Power & Light Co.'s plant at Bonnington Falls, near Nelson, B. C. Originally the entire smelter was run by power from the company's electric plant, situated on the North Fork of Kettle river, below the artificial 'Smelter Lake.' This has long since been outgrown, and is now mainly used for lighting the town.

A large new blower-room is rapidly being completed. This is being built of brick and steel, to replace the old wooden structure, and will contain 8 Root blowers, and two converter blowing-engines, all driven by electric motors. This building will also contain several motor-generators to furnish direct current for operating the cranes and electric locomotives.

The Granby Consolidated Co. is capitalized at $15,000,000, of which $13,500,000 has been issued. Dividends aggregating $3,508,630 have been paid, the latest being in December 1908, when a dividend of $270,000 was paid, at the rate of 2% on the outstanding stock. The dividends are paid quarterly, the rate thus being 8% per annum. The dividend rate prior to 1908 was 12%, the reduction being due to the low price of copper.

Lead in ores may be determined by the following method proposed by Low (*J. Am. Chem. Soc.*, XXX, 587). The Pb is obtained in the form of sulphate by the ordinary method (treating with HNO_3 and finally evaporating with H_2SO_4). The $PbSO_4$ is dissolved from the insoluble matte by means of a hot solution of $NaC_2H_3O_2$ containing a little free acetic acid. From this solution it is precipitated by $K_2Cr_2O_7$ (on 0.5 gm. of ore use 10 c.c. of a 5% solution). Boil for a few minutes, filter, wash once only, then open up the filter, and rinse the $PbCrO_4$ with a hot solution of $H_2C_2O_4$ into the flask, add alcohol, and boil until all the CrO_3 has been reduced, and the precipitate converted to $PbCrO_4$. Filter, and wash 10 times with cold water, treat paper and all in a flask with hot dilute H_2SO_4, and titrate with standard permanganate. The acetate solution for dissolving consists of a cold saturated solution diluted with an equal bulk of water and 40 c.c. of 80% acetic acid added per litre. The oxalic solution is made up of cold saturated solution 1 part, water 3 parts. The permanganate solution as used for Fe titrations is too strong; 1.5185 gm. $K_2Mn_2O_8$ per litre affords a solution such that 1 c.c. equals 1% lead.

Ancachs is one of the largest silver producing departments in Peru. It is also notable for its large deposits of coal, including bituminous, anthracite, and lignite. Within the last four years the mining of coal has increased rapidly with the development of silver-smelting, which industry is increasing despite the present inaccessibility of the district. A railroad is projected from the coast. When built it will bring about a great development of mining enterprise.

MAKUSHIN SULPHUR DEPOSITS, UNALASKA.

Written for the MINING AND SCIENTIFIC PRESS
By N. OLIVER LAWTON.

From time to time it has been rumored that inexhaustible deposits of sulphur existed on the island of Unalaska, in and about the summit of Mt. Makushin; and thus it happened that in the summer of 1906 I made a trip to Unalaska, prepared to ascend Mt. Makushin and solve the problem of the possible commercial value of the sulphur contained in the ancient crater and about the summit. The island of Unalaska is about 1730 miles north of west from Seattle, Washington. It is in latitude 53° 30′ north, longitude 166° 30′ west of Greenwich, and pertains to the territory of Alaska. It is the second largest of the Fox Island group of the Aleutian archipelago and fourth in line off the Alaskan peninsula. There are good harbors on the eastern, northern, and western coasts, where steamers can find safe anchorage and protection from storms, but fogs prevail along the coast and it is often difficult to get in and out. On the northeast coast of the island is Unalaska bay,



Northern Portion of Unalaska.

in which are situated the ports of Dutch Harbor and Unalaska. These ports are perfectly protected from storms; they are only a little off the course of steamers plying along the Pacific coast between Seattle and northern Alaska, and for a great many years were regular ports of call.

The Dutch Harbor port is situated on an island in the bay, and is the supply station of the North American Commercial Co., a company engaged in sealing and trading. There are about 20 buildings, including general store, manager's house, boarding-houses, warehouses, and the like, all owned by the company. A marine hospital (now closed), owned by the United States Government, is situated here, and it is the residence of a customs officer.

The Unalaska port is the headquarters or supply station of the Alaskan Commercial Co., a company extensively engaged in fishing and trading. It is the largest settlement on Unalaska island, having over one hundred dwellings, a Greek church, Methodist mission, U. S. school (now closed), wharves, warehouses, and general store. It is also the residence of a U. S. Deputy Marshall and of the Mining Recorder. The U. S. revenue cutters make the harbors their base of operation in watching the seal fisheries and customs. It is a very easy matter to reach Unalaska island during the months of June, July, August, and September, by taking passage on the Alaska steamers which leave Seattle for Nome.

The climate is moderated by the Japan current, which passes along the southern shore, so that it is never extremely cold near the coast. Strong winds prevail all the year round. The climate appears to be healthy, although the weather is excessively rainy and foggy, especially during the nine months from September to June; during this time there are constant fogs, rains, or snow; the snow gradually replaces the rain inland toward the mountains, where considerable areas are covered with perpetual snow. The U. S. Geological Survey gives the average rainy days per year as two hundred and fifty-nine. The best weather occurs during June, July, and August; still, fogs and rains are frequent even then. At this time of the year the snow disappears from the coast, the valleys, and the lowlands; and usually by the



Smoke Issuing From Crater.

middle of August a great many peaks and ridges near the top of the mountains are bare, as well as considerable portions of the lower slopes. This is the best time to visit the mountain regions, as the areas of rock exposures are greatest, the weather mild and free from snow-storms, and the wind not so continuously strong.

Makushin mountain, on which the sulphur deposits are situated, is still an active volcano, in the solfataric, but not eruptive phase. It stands near the western part of the north end of the island. The maps give the elevation as 5691 ft., while the aneroids I carried gave 5365 ft., the elevation being checked on different occasions. There are several ways by which the summit can be reached from Unalaska or Dutch Harbor. The safest and surest route appears to be by way of Broad bay; it requires more walking, but it is the best trail and there are good places to camp at convenient distances. It is well known to the Indians, therefore they can proceed in fairly foggy weather—an important consideration, as fogs occur frequently and unexpectedly. This route is 6 miles by boat from Unalaska to Broad bay, and 13 miles by trail from Broad bay to the summit.

It is evident from a study of the volcano that Makushin was once violently eruptive, sending forth volcanic material such as ashes, lapilli, scoriae, and

bombs. As the eruptions subsided, peaks and ridges of volcanic rock were left around the summit, making what may be called the outer rim of the old crater and forming a basin several hundred feet deep, now filled with perpetual snow. This rim is shaped like a horse-shoe, making the basin 1½ miles wide (N.E. to S.W) by 2¼ miles long (S.E. to N.W.), open, and grading toward the northwest. During the eruptive phase, the volcano was probably more or less explosive, and the opening in the outer rim toward the northwest is undoubtedly due to a terrific explosion at this period. The basin or old crater must undoubtedly have a very irregular surface underneath the snow. It is now filled with snow to the top, where the strong winds keep it smooth and concave, or saucer-like. The depth of this snow can only be conjectured, but I think it is safe to say it will average over 100 ft., and in places it might reach 200 ft. or more in thickness. This snow is practically ice below the surface, the action of the sun, rains, and pressure causing the consolidation. The heat from the gases, and the warm earth, with an occasional vent in feeble operation, have melted the snow around the edges of ridges within the crater, forming caves underneath it, and I was thus able, in places, to go under the snow-cap as far as 75 ft. Some incrustations of sulphur were found, but most of the ground thus exposed was soft volcanic ash.

The sulphur deposits are within the old outer rim, or crater, on the summit of Makushin mountain. Almost in the centre of this crater, ridges of volcanic ash, with scoriae and bombs, protrude through the snow. These ridges are covered with innumerable holes, cracks, and vents, from which are issuing steam and hot vapors, indicating the present activity of the volcano. Hardly a space 2 ft. square can be found on the ridges which does not contain several of these small holes or vents; there are also several large vents, 10 ft. or more in diameter, through which the gases rush with a loud roar. The vapors or gases are composed principally of sulphuretted hydrogen and sulphurous acid, the sulphuretted hydrogen largely predominating. The deposits are incrustations of crystallized sulphur, formed by the cooling of the mixed gases in contact with the damp volcanic ashes and snow at the surface, and by sublimation. The incrustations of sulphur are not very thick, varying from a few inches to 10, up to 14 in. thick, and occasionally a small spot may be found which measures 18 or even 24 in., but in such cases the deposit contained considerable volcanic ash. From the method of forming these deposits it appears impossible for them to possess any great thickness. The gases leave the interior of the earth at a high temperature; the passage-way becomes heated, and the gases cannot cool before they reach the surface; as soon as the deposit attains a certain thickness, it begins to act as a non-conductor and becomes heated until the gases are no longer cooled sufficiently to cause precipitation. I found that 10 to 14 in. was the average limit of thickness of the deposit, and often 4 to 6 in. of the bottom would be mixed with volcanic ash. This was equally true of the deposits found in a quiescent state under the snow-ice, as well as those on the active ridges still in process of formation; in other words, the thickness and general formation of the sulphur deposits were about the same where cool and where no activity was apparent, as where the vapors and steam were still escaping. Such cooled deposits were exposed in the caves under the snow, along the edge of the active ridge, as further proved by a tunnel which I drove 21 ft. under the snow from one of the caves. I also sunk test pits at other points.

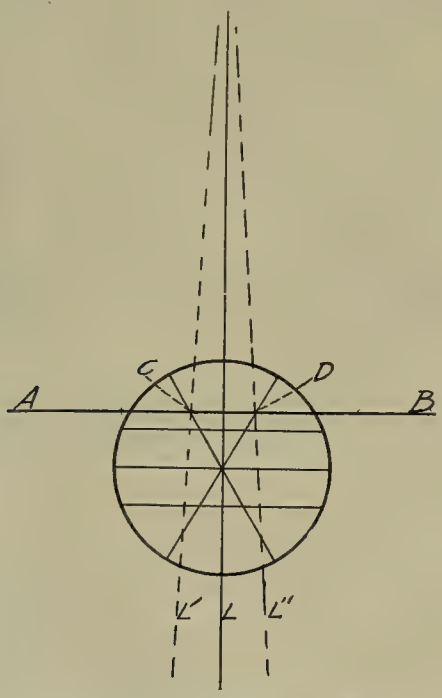
After the surface crust of sulphur was passed, I encountered volcanic ash of varying color and hardness; the color varied from nearly white to dark gray or brown, and the hardness from a soft ash that could be excavated with a shovel to a more hardened material that had to be loosened with a pick. None was found that could not be excavated with a pick and shovel, except an occasional bomb. The temperature of this ash under the sulphur deposit was warm or hot, depending upon the activity of the vents. We often made tea by digging a hole in the sulphur, setting the pot therein, and letting the hot gases heat the water. At one of the large vents we put in a pick-handle, and it was scorched brown but did not catch fire. In all of the test pits, the temperature increased rapidly with depth. Some were sunk a little way from the active part of the ridge, but were so hot at a depth of 5 ft. that they had to be discontinued. Even the bottom of the tunnel which was driven from one of the ice caves was quite warm in the end, and this was 75 ft. from any place where volcanic action was visible.

There is exposed, free from the covering of the snow, 12 to 15 acres of surface, most of which is giving forth gases through small vents. About three acres of this, covering the top of the ridges, and as far as I could see under the snow, contains the deposits of the cleanest, thickest, and best sulphur. They are from 4 to 14 in. thick, and might average 9 to 12 in. The remainder of the exposed surface is covered irregularly with deposits of sulphur, but of inferior grade, being mixed with the volcanic ash in all proportions. The vapors were quite thick in places, and it was difficult to breathe. When the wind was strong we would have to approach the crater 'down the wind', and there were times when the wind would blow the vapors so that it was impossible to continue our exploring. I had to wait until the wind was just right, or when there was no wind at all, for examining the ice-caves under the snow. The best condition was with no wind, but such times were rare. I managed, however, by watching and taking advantage of every favorable chance, to get everywhere on the exposed crater and into a great many of the ice-caves under the snow. There is always the possibility of the volcano becoming eruptive or explosive; in fact, it is reported that such activity occurred last year, covering the settlements of Dutch Harbor with several inches of volcanic ash. The rumors which have clustered about this ancient volcano on the island of Unalaska, claiming the existence of inexhaustible sulphur deposits, are born of the imagination, without sufficient basis of facts to justify most of the assumptions that have been made.

MINE SURVEYING HINTS.

Written for the MINING AND SCIENTIFIC PRESS
By EDMUND D. NORTH.

In taking transit sights underground, the writer has found it advantageous and convenient to have inclined cross-hairs in the telescope, in addition to the regular vertical and horizontal hairs ordinarily used. These hairs should be inclined at about 30° from the vertical, and should cross exactly at the intersection of the vertical and main horizontal hairs. In taking observations on a plumb-wire or wires, as used in transferring surface lines underground, the usefulness of these inclined hairs can readily be seen by reference to the accompanying figure. Close behind each plumb-wire is nailed a light strip of wood, 1 by 3 in., and on this is fastened, by two thumb-tacks, a small sheet of white paper on



which is a straight black line, A B. The paper is so placed that the line A B will he horizontal; a candle is hung in front of the paper and to one side of the plumb-wire. As the plumb-wire will always swing, the telescope is pointed at it approximately, and clamped in both vertical and horizontal motion. By observing the wire as it moves, the transit can readily be so set that the plumb-wire will vibrate equally on either side of the vertical cross-hair, intersecting the inclined cross-hair and the line A B in points C and D. There will always be some irregular vibrations which need not be observed, but the centre of the average vibrations can be easily ascertained by this method. This does away with the use of a graduated scale with tangent-screw, placed behind the plumb-wires, as used by some engineers for ascertaining the centre of vibration, and also has the advantage that the plumb-wires can be left entirely alone after this simple apparatus is placed behind them, as no assistant with light or scale is needed.

Another advantage in these inclined hairs is that they enable the observer to more closely bisect a plumb-bob cord, particularly in a short sight where the cord covers a much greater field than the vertical cross-hair. Still one more advantage in their use is the fact that they so prominently identify the main horizontal cross-hair, that it is practically impossible, in taking vertical angles, to mistake a stadia hair for the main horizontal hair, a mistake otherwise easily made on a candle-lighted object.

Mistakes in tape reading and recording may be avoided by the following method. In drifts and cross-cuts, the distance between stations is measured horizontally from the transit to a point on a plumb-bob string at the station ahead. This point is marked at instrument-height by means of a small knot that can be raised or lowered. The transitman holds the tape, stretches it twice on the line to be measured, and then records the distance without mentioning it. At the next set-up the assistant reads the horizontal tape to the back-sight. If his reading checks with the previous one it shows two things, namely, that the distance was properly measured, and that it was properly recorded, and it is then marked with a small check-mark. This extra back measurement takes only a moment, and will be found well worth while, as mistakes are not infrequently made in this part of the work.

For low-grade copper ores containing much iron, the following method of estimation is recommended by T. R. Marshall: 1 to 3 gm. of finely powdered ore is treated in a flask with 20 c.c. nitric acid and 10 c.c. sulphuric acid, on a hot plate or sand bath. The process is continued until dense fumes of sulphuric acid have been emitted for ten minutes. The addition of hydrochloric acid should be avoided, as it is difficult to eliminate the last traces of chlorine and oxide of nitrogen, owing to secondary reactions occurring with the sulphuric acid. When the contents of the flask have cooled, dilute sulphuric acid and a number of pieces of sheet zinc are added. The best material to employ is the ordinary commercial sheet-zinc. This is cut up into a number of equal-sized squares. In any particular batch of assays an equal number of squares should be used for each assay, and a blank test run to estimate the effect of the zinc on the cyanide solution, as traces of copper might be present. To continue, with the aid of gentle heat, the zinc is quickly dissolved and immediately the reaction is completed the contents of the flask are thrown on a rapid filter of loose texture. The filter paper retains the reduced copper and the insoluble. The filter paper is then pierced, and the residue washed by hot dilute nitric acid into a beaker. The copper in solution as nitrate is then estimated in the usual way by standard cyanide solution after the addition of ammonia. If the same quantities of nitric acid and ammonia are used, and the temperature and volume of the solution are maintained the same in each assay, and a daily control run with a solution containing a known quantity of copper, the results will compare favorably with the electrolytic method.

COMPANY REPORTS.

GOLDFIELD CONSOLIDATED.

George S. Nixon, the president of the Goldfield Consolidated Mines Co., in reporting the progress made for the year ending October 31, 1908, states that the cash on hand, including ore in transit, amounted to $911,295, the new mill and its equipment having been paid for, with the expenditure of $900,000. The plans of the company have been carried out by the construction of a 100-stamp mill and cyanide annex having a capacity of 600 tons per day, also a railroad from the mines to the new mill, together with pipe-line and compressor plant. During the year no labor troubles have hindered operations. Litigation over apex rights has been ended by settlements with neighbors. While working costs have averaged $11.27 per ton on ore treated in the Combination mill, the expense (which includes mining, milling, and transportation) was reduced to $8.81 in October. With the new mill the cost is expected to be $6 per ton, of which $3 will be for milling. Using the Combination mill and the new plant, it is expected to treat "not less than 650 tons per day, of a value equal to that supplied during the year to the Combination mill," namely, $40.21 per ton. This "ought to net the company" not less than $550,000 per month.

During the year the mines of the company have yielded 32,755 tons of ore, averaging $41.50 per ton, and 12,254 tons of $7.76 stuff, now on the dump. The Combination 20-stamp mill treated 28,473 tons, yielding $1,145,157; at the same time the lessees mined 25,540 tons, containing $945,196; thus the output was 70,549 tons, having a gross value of $2,400,191.

The report of the general manager, J. H. Mackenzie, gives additional information: The company now controls 380 acres, besides minor interests. The new mill started on December 26, 1908, on a process of treatment based upon experience in the Combination mill. Briefly stated, the process consists of crushing first in gyratory rock-breakers and then by stamps, with re-grinding to slime in tube-mills; amalgamation both before and after tube-milling; concentration on Deister slime-tables; cyanidation of tailing from concentrators in Pachuca agitators and Butters filter-presses, ending with precipitation of the gold by zinc-dust. The mill cost $790,000, the railway $93,000, and the water service $17,000. As compared to shipping the ore to the smelters, the saving will be $10 per ton. The cost of "ore production" is $1.51, and of development $9.51 per ton, the average being $4.89 per ton. In regard to ore reserves, we quote from Mr. Mackenzie's statement:

"Excepting in the course of exploratory work, no ore has been extracted from your property below a depth of 400 ft., yet the property has yielded over $15,000,000. The total ore produced averaged $73.48 per ton. Owing to the short term of leases and the policy adopted by the lessees of gouging after the high-grade ore only, large quantities of low grade were purposely left; and in their haste a large proportion of high grade was overlooked, and in some cases was left for pillars. It is impossible to measure the ore remaining without driving numerous cross-cuts in the foot and hanging, which would be of little use in the extraction of ore; and not until stoping on a large scale has been carried on for several months can reliable estimates of reserve ore be made.

From the surface to a depth of 400 ft. large blocks of promising territory still remain unexplored, and from the tonnage and value of ore actually exposed, and the past performance of the stopes in the different properties, based on the experience of stoping operations in the Combination mine, it is safe to predict that your property, from the surface to a depth of 400 ft., will produce at least as much as has already been extracted, namely $15,000,000. Below the 400-ft. point results have been very satisfactory. On the Mohawk a winze on the main orebody shows continuous high-grade ore for over 150 ft. on the dip of the vein, and has an average width of about 7 ft. All ore extracted from this winze, amounting to 535 dry tons, was shipped to the sampling works without any sorting whatever, and contained an average value of $124.72 per ton. From the bottom of this winze about 100 ft. of drifting shows average values equally as good for the full width of the drift, with both faces still in good ore. On the 600-ft. level a cross-cut proves this same body of ore to be 20 ft. wide, and although only a few inches show high grade, a 50.5-ton shipment taken as a sample from the width of 24 ft. across the vein gave returns of $31.42 per ton."

CONSOLIDATED MINING & SMELTING CO. OF CANADA.

Year Ending June 30, 1908.

Metal Produced.	Quantity.	Gross Value.	%.
Gold	121,380*	$2,488,289	45.85
Silver	2,224,888*	1,288,992	23.74
Copper	4,004,468†	566,421	10.43
Lead	32,157,139†	1,084,799	19.98
Total value.		$5,428,501	100.00

Tons Smelted:

Lead Furnaces	39,954
Copper Furnaces	266,002
Total Smelted	305,956

Year Ending December 31, 1908.

Metal Produced.	Quantity.	Gross Value.	%.
Gold	116,314*	$2,384,437	47.27
Silver	2,100,457*	1,102,846	21.86
Copper	3,753,139†	506,460	10.04
Lead	35,999,145†	1,050,455	20.83
Total value.		$5,044,198	100.00

Tons Smelted:

Lead Furnaces	51,022
Copper Furnaces	267,384
Total Smelted	318,406

*Ounces. †Pounds.

This company's mines comprise the War Eagle, Centre Star, Idaho, and Enterprise, at Rossland. The smelter is at Trail. The enterprise is controlled by the Canadian Pacific Railway.

SOUTH KALGURLI GOLD MINES.

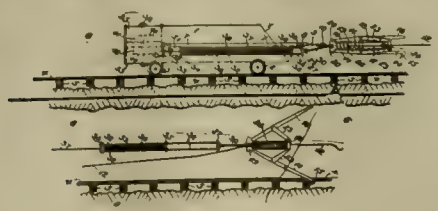
In 1908 the mining profit was £41,166 from the treatment of 105,169 tons of ore of an average assay of 6½ dwt. Two dividends of 6d. each were paid and £5500 written off old development account, leaving, including balance from last year, £619 to be carried forward. The ore reserves blocked out on three sides are 121,868 tons, of an estimated average value of 6.97 dwt. per ton; probable ore on September 30 last, 95,897 tons, of an estimated average value of 6.13 dwt., the increase during the year being 10,829 tons of blocked-out ore and 22,370 tons of probable ore. The liquid assets consist of cash, high-class investments, gold in transit, to the value of £70,000, and all the new plant is paid for.

At the 1500-ft. level, at a distance of 359 ft. from the main shaft in the west cross-cut, a body of ore 14 ft. wide was passed through, averaging 4 dwt. per ton. There are thus three, if not four, distinct orebodies lying to the west of what is termed the Lake View lode. There is a run of highly payable ore at 1000 ft., and large orebodies are being opened at 1200 and 1500 ft. Discovery of rich ore has recently been made in the Lake View mine at a depth of 1900 ft., and another in the Great Boulder Perseverance, at a depth of 1750 ft. The company's prospects of proving the deep ground to be payable seem to be most encouraging. The result of the year's work was extremely satisfactory, considering the low value of the ore worked. A fair profit has been made, and more ore has been developed than had been mined. The discoveries at the 1000 and 1200-ft. levels have been so remarkable, and the indications on the 1500-ft. level are so encouraging that general interest in deep-sinking has been awakened among the mining companies throughout the district.

MINING AND METALLURGICAL PATENTS.

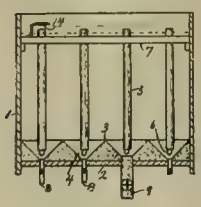
Specially reported for the MINING AND SCIENTIFIC PRESS.

SAFETY DEVICE FOR MINE SKIPS, CAGES, ETC.—No. 902,694. James Spry, East Rand, Transvaal.

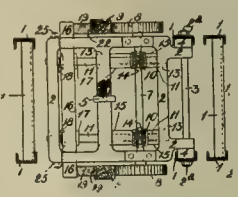


In a safety device of the nature indicated, the combination with the vehicle and winding rope, of a catch gear which is adapted on the breaking of the winding rope to engage an obstruction in the shaft, a brake gear carried by the vehicle, a buffer gear connected with the catch gear, and a connection between the buffer gear and brake gear for operating the brake gear and gradually arresting the movement of the vehicle.

CYANIDE-TANK.—No. 894,254. Ralph S. Browne, Alameda, California.



No. 894,254.



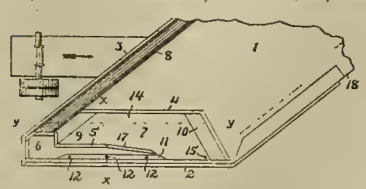
No. 902,703.

In a tank for cyanide solution purposes, the combination with a tank of a series of pockets in the bottom of the tank, an air lift in each pocket, and a pipe extending from the air lift to a point near the top of the tank.

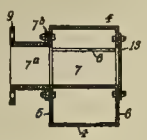
SAFETY BRAKE MECHANISM FOR MINE-CAGES AND THE LIKE.—No. 902,703. Henry A. Walker, Johannesburg, Transvaal.

Safety brake mechanism such as described comprising a vehicle, guiding means therefor, a frame pivoted to said vehicle, means attached to said frame for suspending the vehicle, a shaft revolubly supported by said frame, friction wheels fixed to said shaft and adapted to have contact with the guides when the vehicle is unsupported, a worm on said shaft, a worm wheel in gear with said worm, a second shaft moved by said worm wheel, a beam fixed to the second shaft on the opposite side of the guides to the friction wheels, and brake members pivoted to the vehicle and adapted to be moved by the beam into contact with the guides on the opposite sides to the friction wheels, as set forth.

FEEDING DEVICE FOR ORE-CONCENTRATORS.—No. 895,075. Emil Deister, Fort Wayne, Indiana.



No. 895,075.



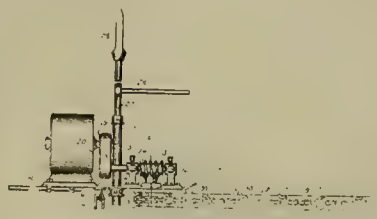
No. 909,292.

In apparatus of the class described, a reciprocating table; a feed box in connection with the table, having a feed chamber and settling chamber which have communication at the forward end of the former, the feed chamber having discharge openings which extend through the bottom of the box, and the settling chamber having a shoal at its forward end and a dam at its rear end, and having also a discharge opening at its forward end adjacent the shoal, and a waste launder having communication with the settling chamber at its rear end adapted to receive the overflow therefrom which passes over the adjacent dam, and being adapted also to convey the same away from the table.

TUBE-MILL.—No. 909,292. Harry W. Hardinge, New York.

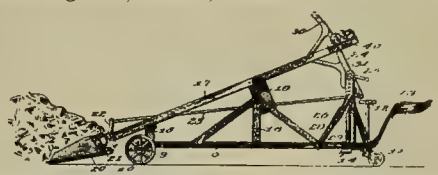
The combination with a rotating tube-mill having a tubular trunnion opening into the same, of a tubular member secured on the end of the trunnion and in line therewith, a spiral scoop removably secured to the tubular member, having an aperture in its contiguous side wall in register with the interior of the tubular member and having a similar aperture in the opposite side wall, and a closure removably secured over the last-mentioned aperture, as set forth.

TRAMWAY LOADING DEVICE.—No. 910,499. Charles A. Case, New York.



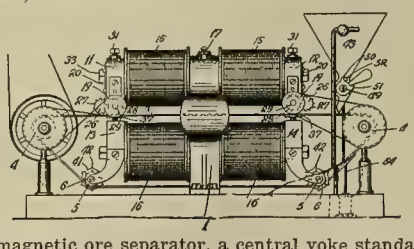
The combination of an aerial tramway, a bucket propelled by a hauling rope of said tramway, a loading hopper supported on tracks adjacent to said tramway, a shaft that can oscillate about and move along its axial line supported on the loading hopper, an arm extending from said shaft, a roller journaled on the bucket in the path of said arm, a second arm extending from said shaft, a wedge located in the path of the second arm to engage therewith and thereby disengage the first arm and the roller on the bucket.

EXCAVATING AND LOADING MACHINE.—No. 909,982. Josephus Bingaman, Garnett, Kansas.



The combination of a wheeled frame, a tilting beam pivoted thereon and provided at its front end with an implement and at its rear end with a segmental rack, a standard mounted on the frame at the rear, a crank shaft carried in bearings on the standard and having thereon a pinion in mesh with the rack, and a detent slidable up and down on the standard and normally engaging the pinion at its upper end and having an offset foot piece at its lower end, for the purpose stated.

MAGNETIC ORE-SEPARATOR.—No. 882,158. Richard R. Moffatt, New York.

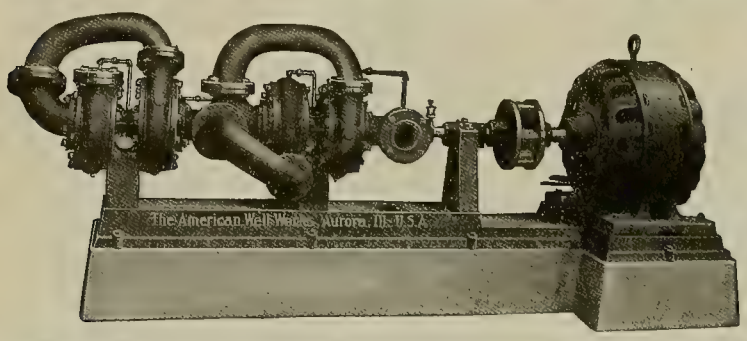


In a magnetic ore separator, a central yoke standard having an aperture, two sets of upper and lower poles arranged on opposite sides of the central yoke standard, upper and lower core pieces extending laterally from both sides of said yoke standard and in magnetic circuit with the poles and yoke standard, a feed conveyor passing between the two sets of poles and through the aperture of the yoke standard, and cross conveyors intersecting the feed conveyor.

New Type of Centrifugal Pump.

A multiple-stage centrifugal pump of a new type that the makers, the American Well Works, Aurora, Ill., assert develops higher efficiency than any heretofore designed is shown in the accompanying illustration. Ordinary centrifugals, as made by the American Well Works, have as their leading characteristic an impeller machined on both sides and edges to the exact size of the volute, with a closely adjusted cut-off at the entrance of the discharge pipe. These features make it impossible for water to pass the outlet and be re-pumped, as the clearance between the impeller and the casing is only about one sixty-fourth of an inch, and this forms a seal against the passage of water. Another feature of these pumps is that the intake and discharge is by long pipe bends, so constructed that no sudden change in direction of the water occurs when passing through the pump, thus reducing friction to a minimum.

In the multiple-stage pumps, the stages are placed close together, to shorten the shaft. The connections between the stages, however, are large pipe-bends of increasing diameter and radius, so designed that a constant expansion is allowed to the flow without sudden change in direction, which reduces the skin-friction to a minimum. The single-stage



types of these pumps operate against total heads up to 125 ft., the two-stage up to 250 ft., the four-stage up to 500 ft., with corresponding increase in heads for additional stages. Efficiencies of 60 to 80% are claimed for these pumps, depending upon the size and working conditions. A recent test of a 3-in., 4-stage centrifugal of this design, pumping from an inclosed pit, and therefore not operating under the most favorable conditions, delivered 460 gal. of water per minute to a height of 440 ft., and maintained an average efficiency of 65%. This pump was designed to deliver only 280 gal. per minute. It is claimed that the ability of these pumps to operate against high heads especially adapts them for mine pumping and for fire-protection service. All bearings in the water-end of the shaft are fitted with automatic hydraulic lubricators, and they therefore require little attention when in operation.

Asbestos wood, an invention of Charles L. Norton, of the Massachusetts Institute of Technology, is a valuable substitute for wood in construction requiring a fireproof or non-conducting substance. It is claimed that it is harder than ordinary wood, and has a transverse strength two-thirds as great. It may be worked with ordinary wood-working tools, and will take paint or varnish readily. Its fire-proof and resistant qualities have been amply proved by experiment. The H. W. Johns-Manville Co., New York, has put asbestos wood on the market in the form of sheets, ridge rolls, shingles, and is prepared to furnish it in any special shapes or sizes.

The Wood Drill Works, Paterson, N. J., has issued a 12-page booklet entitled Wood Rock Drills, giving description of the machines, showing their adaptability to tunnel driving, drilling in concrete, and open-cut work; with detailed costs in driving the Tieton Tunnel of the U. S. Reclamation Service at North Yakima, Washington. The booklet is printed in three colors and can be obtained at any of the company's offices in the United States, Mexico, and Canada.

Publications Received.

Any of the books noticed in these columns are for sale by or can be procured from the Mining and Scientific Press.

The Steam Turbine: A Practical and Theoretical Treatise for Engineers and Designers. By James Ambrose Moyer. 8vo., pp. 379, ill. 225, index. New York. John Wiley & Sons. 1908. Price $4 net.

The steam turbine has reached such a state of efficiency that in a few years it will probably replace reciprocating engines in all large electro-generating power-plants, and even small plants, especially those using fuel gas as motive fluid, will probably outclass the old form of steam engine. The treatise prepared by Mr. Moyer is admirable. It assumes a knowledge of the fundamentals of physics, from which starting point the subject is amplified so as to give a thorough understanding of the principles of the turbine engine. It would be difficult to find anywhere a clearer exposition of the elements of the theory of heat than that given in this book. The theory of nozzle and blade-design are worked out in great detail, the mathematical analysis being elaborate, but not calling for the use of the calculus. It is eminently a book for the designer, and equally valuable for one having the responsibility of operating and maintaining turbine equipment. As engineer for Westinghouse, Church, Kerr & Co., in charge of turbine designing, the author is able to speak with authority on this subject.

Manual of Practical Assaying. By the late H. Van F. Furman; revised by William D. Pardoe. 6th ed. pp. 506. New York. John Wiley & Sons. 1908. Price $3 net.

Furman's 'Assaying' has been so long recognized as a necessary part of every laboratory equipment as to need no comment other than to announce that the new edition is not a mere re-print from old plates. The chapters on zinc, water, and coal analyses have been re-written, and improvements in old methods noted. Chapters have also been added on the assay of telluride ores, tungsten, molybdenum, and vanadium.

The Copper Resources of California. Compiled by the California State Mining Bureau. Bulletin No. 50. Sacramento. 1908. Price, $1.20.

This is a guidebook to localities where copper is found in California, and to companies owning copper mines. Of geology the work fortunately attempts to give little, and it refrains from offering a semblance of commercial data concerning the properties mentioned. It is profusely illustrated, and accompanied with many maps.

A Hand-Book of British Columbia. Bulletin No. 23 of the Bureau of Provincial Information.

The contents are quite general, and comprise information for miners, agriculturists, fruit growers, and manufacturers as to the great possibilities for development in the Province.

New British Columbia is the title of Bulletin No. 22, issued by the same Bureau.

There are 100 pages of description of the undeveloped areas of the great central and northern interior of British Columbia, a region with an obviously rich future before it.

Magnetite Deposits of the Cornwall Type in Pennsylvania. By Arthur C. Spencer. Bulletin No. 359, U. S. Geological Survey.

Geology of the Seward Peninsula Tin Deposits, Alaska. By Adolph Knopf. Bulletin No. 358, U. S. Geological Survey.

Geology of the Taylorsville Region, California. By J. S. Diller. Bulletin No. 353, U. S. Geological Survey.

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EDITORIAL.

GOLDFIELD is the place selected for the next annual convention of the American Mining Congress. This selection meets with general approval and ought to ensure a large attendance. We hope that while it may attract deserved attention to a notable mining centre, no attempt to boost wild-cat stocks will be countenanced by those in control of the Congress.

STRONG effort is being made to get a suitable appropriation from Congress for the Alaska Road Commission. This deserves the support of every Congressman. No better national investment can be made at this time. The main obstacle to the development of the country is the high cost of transportation, due to the difficulty of access to the mining camps. The Road Commission is doing splendid work under Major W. P. Richardson; it deserves enthusiastic support.

IT IS reported that the investigating committee appointed by the Governor of New York for examining the methods of the stock exchanges, has ascertained that the daily quotations of the so-called Metal Exchange have no significance, being merely averages deduced by three men from the scant information available to them concerning the prices at which sales have been made. This fact has long been known, as has also the fact that the metal prices furnished to the daily press are meaningless to those who know, and misleading to those who do not.

FROM the latest information concerning the Italian earthquake it is learned that 120,000 human beings were killed and $20,000,000 worth of property destroyed. In the first shock as many as 60,000 were killed in Messina alone, and 35,000 at Reggio. The first series of shocks lasted 12 minutes and thirty more followed in the succeeding three hours. For purpose of comparison it may be stated that the San Francisco earthquake lasted 65 seconds and caused a loss of life in the region affected of about 1000 persons, together with a destruction of property valued at $500,000,000.

AMONG the investments entered in the inventory of the estate left by Quincy A. Shaw are several blocks of stocks rated as "having no value"; they include Fernando Mining Company, Marysville Dredging Company, New England Exploration Company, San Luis Valley Land and Mining Company, Smuggler Union Mining Company, and Yedras Mining Company. Among the valuable assets are 5500 shares of Calumet & Hecla, appraised at $600 per share, or $3,300,000, and 395,000 United

States Government 4s. at $122, making $481,900. Mr. Shaw has been called the richest man in New England. He did not control interests as vast as several others, but the test of wealth is in the liquidation.

IT IS probable that the Ways and Means Committee, now preparing a new tariff schedule, will reduce the duty on pig lead from 2⅛ cents per pound to 1½ cents. At the present time the London price ranges from 1¼ to 1½ cents lower than the domestic quotation, therefore a reduction such as is contemplated will bring the price to a basis just above the point favoring importation. So far the protest against a decrease in the lead tariff has come from the miners rather than the smelters; this is not remarkable, for, of course, the burden of the lower price for lead will be immediately distributed among the ore producers, the smelter charges being deducted from the value of the metal content. Smelters not themselves engaged in lead mining will not suffer, except in so far as the lower price curtails ore production.

APPARENTLY our friends of the American Mining Congress are doomed to another disappointment. It now seems likely that the Senate will fail to act upon the bill for a Bureau of Mines at this session. Should this happen, the present bill will be killed and a fresh start must be made next year. While the excuse given for not acting, is the crowded condition of the calendar and the necessity for passing the regular appropriation bills, the real opposition comes from Senator Henry M. Teller, who, in this case, represents a reactionary Western sentiment developed by friction with the Forest Service. With him are a few Eastern senators who want no more investigations or investigating bureaus because they "hurt business". It is, of course, true that a Mining Bureau may be innocuous or even harmful as well as helpful, but the bill now before the Senate has been carefully considered, is simple in outline, and provides for an agency likely to be of large service to the mining industry. It deserves a better fate than to be smothered through senatorial courtesy during the closing days of a short session.

MISUSE of titular prefixes is exemplified by a circular letter issued in San Francisco by the Commonwealth Club, announcing that "Dr. James Bryce" is to deliver an address at a forthcoming meeting. James Bryce, the Ambassador of Great Britain to the United States, is known in his own country as the Right Honourable James Bryce, because he is a member of the Privy Council and in America he is known as Mr. James Bryce, the British prefixes of courtesy being without meaning in a democracy. But "Dr. James Bryce" leaves it uncertain whether he is a dentist with diplomatic instincts or a chiropodist of scientific attainments. Speaking seriously, most of us do not associate Mr. Bryce of 'The American Commonwealth' with a doctorate, and the fact of his having been so honored is of no particular consequence, for he honored the grantor university. The use of the title of Doctor for others than physicians has become a question of taste; more particularly, of want of taste.

ON FEBRUARY 1 the National Railways of Mexico formally absorbed the Mexican Central, increasing the permanent way under control of the Government to 7012 miles. The matter is significant as indicating the practical success that has attended the system of governmental administration of railways in Mexico. Official corruption is prevented by a complete severance of railroad management from the political mechanism of the Republic. The Mexican Central, for example, continues as a separate corporation, and is operated by the National Railways of Mexico by virtue of government ownership of 70 per cent of the Mexican Central stock. The management continues unchanged, and promotion for merit is observed as it is by well-organized railroad corporations in the United States. The National railways are subject to the rulings of the Railway Commission, a body representing both the private and government-controlled lines, that is vested with absolute authority in the fixing of rates. The Mexican system permits of no discrimination, no graft by favored shippers to be divided with conniving officials, and the adjustment of rates is made to insure profit to the transportation line and to benefit the shipper. It is interesting to note that, as Mexico is committed in principle to a protective tariff policy, the adjustment of freight rates has been used as an instrument to facilitate the same purpose.

Copper Statistics.

Copper statistics have been issued from two sources: the Copper Producers' Association has made its first report, through its secretary, Mr. L. C. Graton, showing that the stock of marketable copper on hand in the United States on January 1 was 122,357,266 pounds, the production in the United States during January was 112,135,200 pounds, while the deliveries for consumption and export during the same month were 90,362,421, leaving a stock on hand, on February 1, amounting to 144,130,045 pounds. This is not cheerful from the mine operator's point of view, but it confirms our understanding that the mining companies have found difficulty in disposing of their metal. According to the Bureau of Statistics, in the Department of Commerce and Labor, the value of copper and manufactures of copper exported during December was $6,958,710, which compares with $11,337,544 in the corresponding month of the year previous. The total copper exported during 1908 amounted to $90,555,503, as compared to $100,800,355 in 1907 and $89,013,011 in 1906. Furthermore, the monthly report issued by James Lewis & Sons, Liverpool, shows a total stock in England and France of 45,535 tons of copper on February 1, 1909, as against 13,360 tons a year ago, and 8691 tons in 1907. The total visible supply available for European necessities is given as 52,935 tons as against 20,660 tons a year ago. No wonder the copper market is weak.

Tartuffe in Colorado.

Humor is requisite in viewing some of the efforts to stop fraud in mining; only an appreciation of the absurdity of the pose adopted by certain pseudo-reformers, themselves the worst culprits, can deter the observer from making savage comment. Insincerity is provoking, and the most objectionable is that of the man who plays with public sentiment. We are reminded of a State official who makes a great fuss about putting down fraud with his right hand, while his left is doing service for corruptionists: of men who pose as defenders of the common good while acting in behalf of predatory powers. California is blighted with several performers of this type, and if the reader cannot identify them even though vaguely described, he is ill informed. But local politics and local finance are such an *olla podrida* that we shall not at this time enquire further, a more amusing illustration having been offered in Colorado. In the city of Denver there is a paper called *The Mining Investor*, edited by a suave and capable gentleman, who poses as the defender of the guileless investor, meaning thereby the ignorant gambler in mining stocks of the kind that are peddled with an announcement that "the price will be raised to 15 cents on Friday." Not content, however, with the support of those who advertise such lures, this *amicus curiae* to the supposititious mining investor undertakes to castigate fraudulent promotions and irresponsible financial schemes; and yet, on closer investigation, the chief apparent difference between the promoter applauded and the promoter attacked, between the one who receives a bow and the one who is slapped in the face, is that the one does, and the other does not, advertise in *The Mining Investor*. In other words, the publisher of that financial mentor to simpletons is careful not to let his right hand know what his left hand doeth; it is an extreme form of mental detachment. But this is not all. In the last issue of this peculiar journal we are amused to see an attack upon the American Mining Congress because, while making a show of fighting fraud in mining, it has sheltered two gentlemen "conspicuously inefficient or unfair in their dealings with the public," in plain words, two promoters of shady repute. Now whether these gentlemen merit this description or not, the point of the episode is the humor if it. Here is the *Investor* devoting a couple of pages of verbosity to protest against the inconsistency of the Mining Congress in honoring the exponents of the very practices against which the Congress is fighting. This is too funny! The editor of the *Investor* lives in a conservatory full of fungi and ought not like a small boy to play with catapults. For, turning to another page of the same issue we find the advertisement of a Mr. Davis who "will divide more than $60,000,000" to those who buy shares from him; on another page you are offered stock at 3 cents that will soon go to $1; on another a Mr. Kennedy who is sacking $150 ore gives you the chance to buy stock at 15 cents per share, and you can have five months time to pay for it; on another, a fortune in Nevada petroleum awaits you, although the recent report of the Geological Survey gives information to the contrary. And the gentleman who derives his revenue from advertising such schemes is the one who takes it upon himself to criticize the Mining Congress. He must wash his own hands first with antiseptic soap. Fraud is bad; humbug is worse.

Mining and Metallurgical Society.

From the presidential address delivered by Mr. H. S. Munroe at the annual meeting of the Mining and Metallurgical Society of America, it appears that good progress is being made by the new organization. As yet, however, the activities of the Society have been restricted to the meetings of two local sections, one at New York and the other in San Francisco. Each has done some useful work, and hopes to do more, but it has already been demonstrated that the rules which suit the New York division do not please the co-ordinate branch of the Society in San Francisco. The latter asks for more latitude, verging upon local autonomy, strengthened by affiliation with the headquarters division on the other side of the continent. Undoubtedly the gentlemen in San Francisco have broken some rules in the making of which they had nothing to say, and they require disciplining in the interest of the Society as a whole, but they ought to be gently treated, because their purpose was that for which the Society was formed, and the section ought to be forgiven for declining to accept the status of a younger brother. Joking apart, the Society will make a blunder if it become too much identified with the New York group; for instance, one of the gentlemen on Manhattan island remarked that "the New York section, which was the first section to be organized, has found no difficulty in complying with the rules prescribed by the Council, and, inasmuch as the rules have been thus demonstrated to be workable, there is no reason why other sections should not comply with them and follow the same lines as the New York section." This is amusing, for it must be remembered that the executive committee of the Society consists of the New York men who formulated the rules; naturally they like them, while the men in San Francisco, who had nothing to do with the devising of such rules, desire to amend them. From the thoughtless observation just quoted it is pleasing to refer to the true note sounded by Mr. H. M. Chance, the founder of the Society, who "advocated the allowance of latitude to the local sections wherever it did not interfere with the spirit of the organization as a whole." A little sense of humor will prevent trouble. Long ago California had a historic scientific society "on the Stanislaus", but that was in the foot-hills of the Sierras; we have moved to the placid Bay of San Francisco since then and no longer use "chunks of Old Red Sandstone" in a lethal way. It is well to emphasize the fact that the United States has several centres of intellectual and industrial activity; New York is not to America as London is to England or Paris to France; there are Boston, Washington, Philadelphia, Chicago, Denver, and other cities. As one of the others, San Francisco begs leave to point

out that the time has passed when professional men living on the frontier have to go to New York or Boston to get physical or mental nourishment, psychical or financial stimulus. The frontier has vanished; it is somewhere near Guam, and we who live on this side of the continent find it pleasant but no longer necessary to visit New York at frequent intervals. As regards the new Society, the members in the West are glad that the headquarters should be at New York, and also that the officers should be residents of that superb city, but they are not prepared to be considered as the small boy of the family.

Yukon Gold.

On another page we publish the major portion of a letter sent recently by the president of the Yukon Gold Company to the shareholders. This letter, presumably, is a substitute for an interim report; but it is an inadequate substitute. While interesting, the information given is too general; it has the character of an interview in the daily press rather than a statement meant for partners in an important enterprise. Looking at the report from the standpoint of a shareholder—a position, needless to say, we do *not* occupy—it would seem proper to expect a clear statement of the salient facts: cost of mining, yield of gold, results of experimental work, expenditure on the ditch, cost of thawing, money expended in new plant. No reference is made to the fiasco of last March, when Mr. Thomas W. Lawson of Boston played the fool with the Yukon Gold, nor is any account given of the money raised by the filibustering operations in which Mr. W. B. Thompson's services were utilized. At that time we criticized the entire financial scheme, more particularly the attempt to inflate the value of the stock by means of wild statements advertised by Lawson. We showed then that according to the reports available, Yukon Gold was worth about $3 per share; we have found no reason to change this appraisal, although better able to appreciate the general accuracy of the estimates of the engineers who made the reports. Further information concerning the character of the operations at Dawson has increased our good opinion of the skill and energy shown by Messrs. O. B. Perry, C. A. Thomas, A. N. C. Treadgold, and their co-adjutors in the construction and development that will make the Yukon Gold a great gold mine, but nothing has transpired to alter our conclusion that the Yukon Gold was wretchedly financed. In the Guggenheim Exploration Company's annual report the Yukon Gold is put down for $8,222,062 as against $8,222,109 last year, from which it is to be inferred that this asset has diminished $47 in value. Apparently it is thought proper for presidents and directors to go through the motions of giving information to the shareholders for whom they act as trustees, instead of treating them as partners. Imagine Mr. S. R. Guggenheim sending such a vague epistle to a member of his firm. Shareholders are partners; directors are trustees; the sooner these relations are recognized the better for the mining industry.

BY THE WAY.

On the centenary of Lincoln and Darwin, February 12, an address was delivered by Henry Fairfield Osborn at Columbia University, New York. He said, in part:

Widely different in their lives, Darwin and Lincoln were yet alike in simplicity of character and of language, in love of truth, in abhorrence of slavery, and especially in unconsciousness of their power. Both were at a loss to understand their influence over other men. "I am nothing, and truth is everything," once wrote Lincoln. "With such moderate abilities as I possess," wrote Darwin, in concluding his autobiography, "it is truly surprising that I should have influenced to a considerable extent the belief of scientific men on some important points. My success as a man of science has been determined, as far as I can judge, by complex and diversified mental qualities and conditions. Of these, the most important have been the love of science, unbounded patience in long reflecting over any subject, industry in observing and collecting facts, a fair share of invention, as well as of common sense."

Lincoln's greatest single act was his death blow to slavery. Man had been fighting for centuries for his freedom—in labor, in government, in religion, and in mind. It is certainly notable that the final victory for bodily liberty was won during the very years which witnessed the final victory for mental liberty. I do not see that Darwin's supreme service to his fellow men was his demonstration of evolution—man could have lived on quite as happily, and perhaps more morally, under the old notion that he was specially made in the image of his maker. Darwin's supreme service was that he won for man absolute freedom in the study of the laws of nature; he literally fulfilled the saying of St. John, "Ye shall know the truth, and the truth shall make you free."

It is difficult for the college student in this day of liberty, if not of license, to realize that, in the words of Lowell: "We breathe cheaply in the common air thoughts that great hearts once broke for."

When, in 1844, Darwin communicated to the botanist Hooker, under the promise of secrecy, his outline of evolution, he well knew he opprobrium it would bring, for he subsequently added (1846): "When my notes are published, I shall fall infinitely low in the opinion of all sound naturalists—so this is my prospect for the future."

Where his great predecessors Buffon and Lamarck had failed, Darwin won through his unparalleled genius as an observer and reasoner, through the absolutely irresistible force of the facts he had assembled, and through the simplicity of his presentation. Lacking the literary graces of his grandfather Erasmus Darwin and the obscurity of Spencer, Darwin was understood by everyone, as everyone could understand Lincoln. It is true the cause was immediately championed by able men, but victory was gained not by the vehement and radical Haeckel, nor yet by the masterly fighter Huxley, but through the resistless power of truth as Darwin saw it and presented it. It

was not a denial, as had been the great skeptical movement of the end of the eighteenth century, but an affirmation. Darwin was not destroying; yet at the time good and honest men trembled as if passing through an earthquake, for in the whole history of human thought there had been no such cataclysm.

In July 1837 he began his notes on the transmutation of species, based on purely Baconian principles, on the rigid collection of facts which would bear in any way on the variation of animals and plants under domestication and in nature. Rare as was his reasoning power, his powers of observation were of a still more unique order. He persistently and doggedly followed every clue; he noticed little things which escaped others; he always noted exceptions, and at once jotted down facts opposed to his theories.

The three memorable features of Darwin's greatest work, 'The Origin of Species', are, that he was 21 years in preparing it; that, although by 1844 he was a strongly convinced evolutionist and natural selectionist, he kept on with his observations for 15 years, and the volume even then would have been still longer postponed but for a wonderful coincidence, which constitutes the third and not the least memorable feature. This coincidence was that Wallace had also become an evolutionist, and had also discovered the principle of natural selection through reading the same essay of Malthus which had brought Darwin to a solution. It is further remarkable that of all persons Wallace selected Darwin as the one to whom to send his paper. It was then, through the persuasion of the great botanist Hooker, who had known Darwin's views for 13 years, that these independent discoveries were published jointly on July 1, 1858. All the finest points of Darwin's personal character were displayed at this time; in fact, the entire Darwin-Wallace history up to and including Wallace's noble and self-depreciatory tribute to Darwin on July 1 of last summer, is one of the brightest chapters in the history of science.

There is no denying that there is today a wide reaction against the central feature of Darwin's thought. Now, on this centenary, when we are honoring Darwin, many may ask, exactly what is Darwinism? Failure to know leads some to doubt, others to predict a decline, especially where "the wish is father to the thought." Nothing could be less true than to say that there is the least abatement in the force of the main teaching of this great leader, namely, of the evolutionary law of the universe. The vitality of this idea is shown by its invasion of the physical world. Again, Darwinism is the sum of Darwin's observations on earth structure, on plants, animals, and man.

This vast body of truth and of interpretation still so far surpasses that brought forward by any other observer of nature, and these facts and interpretations are so far confirmed that they have become the very foundation stones of modern biology and geology. Finally, looking at Darwinism as the sum of his generalizations as to the processes of evolution, we again find a vast body of well established laws which are daily becoming more evident.

Latest Market Reports.

LOCAL METAL PRICES—February 18.

Antimony	12@16c	Quicksilver (flask)	44½@45½
Electrolytic Copper	15¼@16½	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33¼c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 11. £. s. d.	Feb. 18. £. s. d.
Camp Bird	0 15 6	0 16 6
El Oro	1 3 9	1 3 9
Esperanza	3 0 0	3 0 6
Dolores	1 10 0	1 10 0
Oroville Dredging	0 9 9	0 11 0
Mexico Mines	4 17 6	4 17 6
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Feb. 12	Holiday.	No market.		
" 13	18.12	4 01	4.73	51¾
" 14	Sunday.	No market.		
" 15	13.12	4 01	4.73	51½
" 16	13.06	4.01	4.73	51¼
" 17	13.06	4.01	4.73	51⅜
" 18	13.06	4.01	4.73	51⅛

SOUTHERN NEVADA STOCKS.

San Francisco, February 18.

Atlanta	$ 13	Mayflower	15
Belmont	87	Midway	22
Booth	21	Montana Tonopah	76
Columbia Mtn.	14	Nevada Hills	1.45
Combination Fraction	1.10	Pittsburg Silver Peak	80
Daisy	71	Rawhide Queen	33
Fairview Eagle	25	Round Mountain	85
Florence	3.85	Sandstorm	15
Goldfield Con.	7.85	Silver Pick	9
Gold Kewenas	22	St. Ives	15
Great Bend	21	Tonopah Extension	75
Jim Butler	15	Tonopah of Nevada	6.15
Jumbo Extension	15	Tramp Con.	10
MacNamara	38	West End	33

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Feb. 11.	Feb. 18.
Amalgamated Copper	77½	73⅝
American Smelting & Refining Co.	87¾	85⅛
Boston Copper	13⅛	12
Butte Coalition	24½	23
Cumberland Ely	8⅜	8⅛
Dolores	7	6¼
El Rayo	3¼	3¼
Giroux	8⅛	7½
Greene-Cananea	10⅝	10¼
Indiana Sonora	4¾	3¾
La Rose	6⅞	6½
Miami Copper	14⅜	13½
Nevada Consolidated	18⅝	18⅛
Newhouse	4⅞	4¾
Nipissing	9⅞	9⅝
Ohio Copper	6½	6⅞
Tennessee Copper	41⅛	39⅛
Utah Copper	44¾	43⅜
Yukon	4¾	4⅝

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. February 18.		Closing prices. February 18.
Adventure	7¾	Nevada Con.	18
Allouez	41	North Butte	72½
Arcadian	4	Old Dominion	50
Atlantic	16	Osceola	134
Boston Con.	12	Parrot	27½
Calumet & Arizona	101½	Quincy	89
Calumet & Hecla	640	Santa Fe	2¼
Centennial	32½	Shannon	14⅞
Copper Range	73½	Superior & Pittsburg	15⅜
Daly-West	9½	Tamarack	83
First National Copper	7½	Tennessee Copper	39
Franklin	14¼	Trinity	12½
Granby	98	United Copper Con.	13
Greene-Cananea, ctf	10¼	Utah Apex	6
Isle Royale	30⅝	Utah Consolidated	40
Lake	18	Victoria	4¾
Mass.	5¼	Winona	5
Mohawk	62½	Wolverine	146

(By courtesy of E. F. Hutton & Co., 490 California St.)

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

HIRAM W. HIXON is traveling in Italy.

JOHN M. BOUTWELL is at Bisbee, Arizona.

GELASIO CAETANI is still at Treadwell, Alaska.

W. A. FARISH spent last week at Los Angeles.

H. FOSTER BAIN was in San Francisco this week.

A. H. DOUGLAS has gone to Matagalpa, Nicaragua.

EVERARD ARNOLD has returned from Mexico to Ely, Nevada.

ALFRED VON DER ROPP is on his way to Geneva, Switzerland.

EDMOND N. SKINNER was married on February 4 at New York.

S. F. SHAW is examining mines in Cochise county, Arizona.

A. W. WARWICK has recovered from illness and is now at Denver.

R. V. NORRIS delivered a course of lectures on coal mining at Harvard.

PHILIP WISEMAN, superintendent of the Ray mine, at Kelvin, Arizona, was at Los Angeles.

MARK R. LAMB is now in the mining machinery department of the Allis-Chalmers Co., at Milwaukee.

GEORGE A. LONSBERY and GEORGE KISLINGBURY, of Los Angeles, have been to the Parker district, Arizona.

W. G. ANDERSON, manager for the Iona Gold Mines at Smuggler, Colorado, is on a visit to the Eastern States and Canada.

CLYDE H. JAY, mining engineer, of Salt Lake City, is examining mines in the Monarch district, Chaffee county, Colorado.

C. G. PATTERSON has gone to Mexico, after completing a Butters installation in the mill of the Goldfield Consolidated Mines Co., Nevada.

H. H. DYER has resigned as superintendent of the Shannon Copper Co., and has opened an office as consulting mining engineer at Los Angeles.

S. B. CHRISTY and J. B. TYRRELL are among those recently chosen as corresponding members of the Council of the Institution of Mining and Metallurgy, London.

HENRY S. WASHINGTON, of Washington & Lewis, mining geologists, New York, has returned to Brazil, where he will spend three or four months in professional work in the diamond fields.

THE thirty-sixth annual dinner of the alumni of the Royal School of Mines will be held at the Hotel Cecil, London, on March 30. The chair will be taken by F. W. Rudler. Tickets can be obtained from George T. Holloway, 57 Chancery Lane, London.

A special meeting of the Pacific Coast Section of the Mining and Metallurgical Society of America was held at the Pacific Union Club, San Francisco, on the evening of February 13. Those present included S. B. Christy, Charles Butters, F. W. Bradley, M. L. Requa, W. H. Shockley, Ernest A. Hersam, and T. A. Rickard.

The presidential address of Mr. Henry S. Munroe having been read, together with correspondence between the local Secretary and the Secretary in New York, F. W. Bradley moved that: Whereas the meetings of the Section having been found enjoyable and useful, and it is desirable to continue them under the name of the Society, and whereas it has been found impracticable to fit the proceedings to the rules laid down in New York, therefore, it is advisable to develop rules suited to local conditions, while keeping in touch with the central office in New York.

This was seconded by Charles Butters and carried unanimously.

T. A. Rickard moved that every qualified applicant to membership shall be balloted for and elected by the members belonging to the section in which the applicant lives.

Seconded by W. H. Shockley and carried unanimously.

E. A. Hersam moved that the local dues be $5 per annum.

Seconded by M. L. Requa and carried unanimously.

It was arranged to hold the next meeting on March 13, at the Key Route Inn, Oakland. The arrangements for the dinner were placed in the hands of Charles Butters, to whom members should write as soon as they know whether they will be able to attend.

Bert Peterson.

In our last issue a brief mention was made of the death of Bert Peterson, the manager of the El Rayo mines of Santa Barbara, Chihuahua, Mexico. His mining experience was confined to Mexico, where he went some twenty years ago from his home at Paterson, New Jersey, at the age of twenty-one.

His first work was in and around the Guggenheim lead properties at Monterrey. He next became manager of the Sierra Mojada mines in Coahuila. In 1899, he was made general manager of the Grand Central at Minas Prietas, Sonora, this being one of the properties originally brought out by the London Exploration Co. In 1901, Bert Peterson was offered the general management of the property of the El Oro Mining & Railway Co. at El Oro, but as he had then become personally interested in a number of mining properties he decided to give his attention to their further development rather than to continue professional work. One of the properties in which he was personally interested is now known as the Ajuchitlan and is situated in the State of Queretaro. Another, now known as the El Rayo mines, is situated near Santa Barbara, Chihuahua. Peterson had a long hard struggle in putting these properties on their feet and did not succeed in doing this until after a sale of the El Rayo had been made in New York. As a condition of the sale, he was obliged to take over the management of the El Rayo property and become responsible for all the statements he had made regarding it. Thus Peterson was enabled to secure sufficient funds to equip the Ajuchitlan mine, a property that recently paid its first dividend and promises to develop into an important gold mine.

At the time of his death Peterson had almost pulled the El Rayo property through its experimental metallurgical stage, and he was so confident of 'making good' as to all his predictions regarding it that he was planning to retire from the management next April. The El Rayo operations, however, had called forth so much hard work and worry that Peterson's health became seriously impaired and his vitality undermined. Against the advice of his family, who knew that his health was being injured, he persisted in his work and made a brave fight for his professional name. It may indeed be truthfully said that he gave up his life in order to maintain his professional reputation. He had promised his associates and friends that he would redeem all the promises he had made regarding the El Rayo property and they could not deter him from carrying out this self-imposed task. Last December he sent his wife and 3-year old boy to his home in Philadelphia for the Christmas vacation. Although ill, he refused to accompany them on the plea that the El Rayo needed his constant attention. On their return, Peterson got up from his sick bed to meet them at El Paso, and in doing so rode on horseback some 12 miles in order to catch the train at Santa Barbara. On his return to the mine he was compelled to go back to bed and it was only as the result of the constant urging of his family and friends that he reluctantly consented to proceed to Los Angeles for proper care and treatment. His sickness was diagnosed as typhoid fever, the crisis of which he did not survive because of his worn-out condition. He was well and favorably known throughout Mexico and leaves many friends, whose deepest sympathy goes out to his wife and child.

General Mining News.

ALASKA.

Alaska Venus Mining Co., of Spokane, capitalized for $2,000,000, has been incorporated by Frederic Wright, Frank Vay, and Joseph Parker. The property consists of four claims lying near the water 10 miles south of Juneau. Wright says there is an 8-ft. vein 4500 ft. long on the claims, and that it carries good gold values. An adit has been driven 137 ft. on the vein and the surface has been stripped, showing uniform values. A small stamp-mill will be installed this spring, to be run by water from a snow-fed stream which crosses the property.

(Special Correspondence).—Recent arrivals from Innoko and Kuskokwim report that the scarcity of provisions have forced many to leave the district for Nome, but about 150 men have remained for the winter at Innoko, and have been staking out claims in the region around Ophir and Little creeks.——The people of Innoko City, at the mouth of the Ditna river, are for the most part moving to Diskakat.——There are good summer diggings at Gaines creek, but the operators have been much troubled by water.——The annual report of the Mayor of Hot Springs shows that to date there have been built 165 miles of wagon-road, 383 miles of sleigh-road, and 241 miles of trail. The Mayor speaks very highly of the agricultural possibilities of Alaska.——Owing to the large increase in business the Signal Corps is now stringing a second wire from Fairbanks to Valdez.——A well-defined vein is being prospected by D. H. Cameron on Chatham and Bedrock creeks at the head of Cleary creek.——Quartz discoveries in the Tanana valley have caused much interest to the inhabitants of Fairbanks, several samples having assayed $24 and over. ——Jerome Chute, Thomas McConnell, and R. M. Crawford have purchased the holdings of 'Red' Rogers and are bringing in an Allis-Chalmers 3-stamp mill from 'outside'.—— The annual report of Wilfred B. Hoggatt, Governor of Alaska, gives the population of Alaska in Judicial divisions as 9000 in the first, 10,000 in the second (with Nome as centre), and 12,000 in the third (Fairbanks) division. The native population is approximately 35,000, and there is also a floating population of six or seven thousand miners, cannery men, etc., who only come into the country in summer.

Hot Springs, January 27.

ARIZONA.

GILA COUNTY.

Notwithstanding that work at the Arizona Commercial Copper property on the 700-ft. level has been necessarily delayed awaiting the installation of new pumps to handle the increased flow of water, there have been recent important underground developments. At a depth of 710 ft. in the Eureka shaft a station is being cut 36 ft. square. In cutting this station, good copper ore has been found, and cross-cutting will be started immediately. Connection is now being made between the 500 and 556-ft. levels by means of a raise which has already progressed 28 ft., and averages 6% copper for the entire width.

GRAHAM COUNTY.

The Arizona Copper Co. suffered a destructive fire during the month of January, which put the works and smelter out of business a number of days. Nevertheless the company has finished up the month with an output of 1064 tons of blister copper, which is only 300 tons less than the normal amount.

CALIFORNIA.

INYO COUNTY

(Special Correspondence).—Senator T. L. Oddie, of Tonopah, and a syndicate of Chicago and Philadelphia capitalists have secured the Dixon water rights on the upper Kings river, and plan to construct a large power-plant to supply electricity to the mining camps of southern Nevada and numerous points in California. The projects of the new company involve expenditures approximating $9,000,000. It is understood that the new company will compete with the Nevada-California Power Co., supplying electricity to Goldfield, Tonopah, and other points.——The Natural Soda Products Co. is building a $100,000 plant near the shores of Owens lake. It is ultimately intended to add two more units of the same size. R. G. Paddock is directing the work.——Reports from Greenwater are to the effect that a 60-ft. body of sulphide ore, running about 5% copper, has been encountered in the Greenwater-Death Valley mine at a depth of 1000 ft. The shaft is being sunk to the 1500-ft. level, from which point cross-cutting will be done to determine the persistence of the orebody.——At the Greenwater Central work has started on the sinking of a 2-compartment shaft. The shaft is about 250 ft. from the Greenwater-Death Valley mine and is designed to cut the orebody encountered in the latter.——At the Lida C. mine a large force of men are working and a normal output of borax is being maintained.——The 20-stamp mill at the Orange Blossom is handling 80 tons of ore per day. A large reserve of fair-grade ore has been opened up as far as the 200-ft. level.——At the Orange Blossom Extension an 8-stamp Nissen mill is handling good ore. The shaft wil be carried down to the 1000-ft. level and other developments done on a similar large scale.——The Fitting mine is working 50 men and maintaining steady shipments of excellent ore. Three teams are constantly engaged hauling the ore from the mine to the railroad.

Bishop, February 13.

NEVADA COUNTY.

Official announcement is made that the Brunswick mine will resume operations, and that a perpendicular shaft will be sunk in new ground to join the old workings at a depth of about 1200 ft. The directors have elected a new president, J. W. Pew, who represents the Eastern syndicate controlling the stock. On good authority it is stated that Christopher Mallen resumes his position of superintendent and that Frank McDavitt will be promoted to the office of foreman.——Le Roy M. Clark, while developing a vein of quartz near the junction of the Red Dog and You Bet roads, came across a vein of new ore which turns out to be bauxite, the hydrous oxide of aluminum. He is said to be enquiring if he can find metallurgists to treat the new deposit.——Recently the middle parallel vein of the Marcotte mine was cut in the lower adit. When the vein was first reached it was only six inches wide, but now has increased to about six feet, and shows abundant galena. J. M. Fly is manager.

PLACER COUNTY.

The Southern Pacific is beginning construction work on another line between Roseville and Truckee, which will lower the elevation of the tracks by 1000 ft. and give a maximum grade of 1.5% instead of the present grade of 2.2%. The work will involve the driving of a six-mile tunnel, and will require about four years to complete.

SHASTA COUNTY.

The damage of the recent washout on the Balaklala spur-track connecting with the Southern Pacific at Coram, has been entirely repaired. A trestle was built by the Southern Pacific Co. to replace the fill that had been washed out, and traffic was resumed. Some of the fluxing supplies had run quite low, especially limestone. The Balaklala mine is the most extensive property in Shasta county and the smelter is the largest in California. About 500 men are at present employed at the mines and plant, and two of the furnaces are in full operation. Besides the ore from the Balaklala mines, the smelter is treating a considerable tonnage from the Shasta King mine of the Trinity Copper Co. At present the smelter is treating about 1000 tons of ore per day. Fluxes are received from numerous points in California and Nevada, and are not usually the cause of any difficulties.——Morgan Thomas has resigned his position as superintendent of the Balaklala and Shasta King mines. He will spend a few weeks on vacation.——At the Midas mine 20 stamps are working on ore from the deep-

est workings, or from the Gold Hill claim. The practice of roasting tailing before cyaniding has been discontinued.

TRINITY COUNTY.

H. P. Nelson, president of the Trinity River Mining Co., announces that only a hundred feet or so are required to complete the tunnel which is to turn the course of the Trinity river at Horseshoe bend near Lewiston. At one time during the high floods the river threatened to fill the workings before they were ready, and stopped work in the face till the river fell. The tunnel will be 1450 ft. long, and 8 by 10 ft. in the clear, enabling it to carry the entire flow of the river during at least 9 months of the year. It will thereby expose a stretch of two miles of gravel for mining purposes. H. P. Nelson is president, John Lantsen vice-president, Hans Lassen treasurer, W. R. Thomas secretary, and the offices are situated in Oakland.——The Trinity Gold Mining Co. is working between 20 and 25 men. Three giants are running successfully on the body of gravel that was given a shaking-up by the big blast of a few weeks ago.——The Butler Mining Co. is using only one giant. Five men are employed. The water supply for the pipe-lines is more than ample.

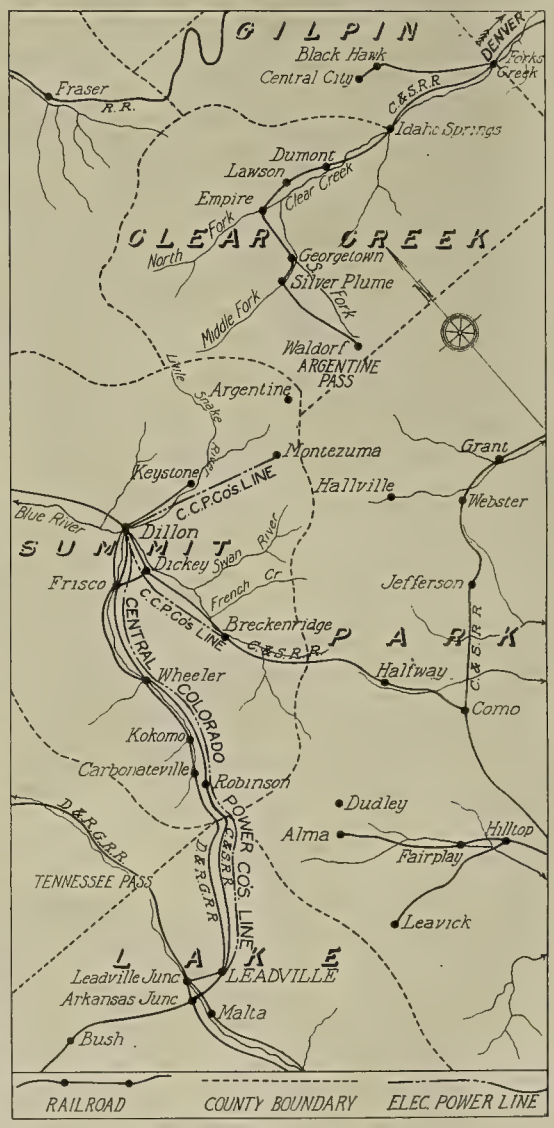
TUOLUMNE COUNTY.

At the Riverside mine, operated by a Tennessee company, 12 men are employed. Ore is being extracted and milled, and adit No. 2 is being driven; preparations are also being made for installing an air-compressor and power-drills.——The Spotted Fawn is giving promise of becoming a v mine. Thirty tons of ore recently milled gave returns far better than were expected, and as a result the working crew will be increased.——The mill at the Arbona mine, at Tuttletown, will soon be running night and day. At present it is in operation only during daytime, on ore from the first, second, and third levels. The crew numbers 12 men, but when the fourth level has been opened up a larger crew will be employed.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence.)—The Geneva Extension M. M. T. & T. Co. has been organized by E. K. Cass. A group of 33 lode-mining claims in the Peru district has been obtained, and work has already been put under way. An adit is being driven to intersect the series of veins in depth, two having already been passed. The Star was a former heavy producer of silver-lead ore, and is an extension of the Revenue, which has produced over $1,000,000. Arrangements have been made to work the mine through the Mallory adit of the Revenue.——Another contract is to be awarded about March 1 for driving the Vidler tunnel an additional 500 ft. The bore is now in 4000 ft. on this side of the range. It is understood that as soon as the weather permits, work will be put under way from the western side of the range. Progress will then be made at the rate of from 10 to 12 ft. per day, and as there only remain 2600 ft. of ground to be broken before the connection is made, the work should be completed during the present year. It is the intention of the Argentine-Montezuma M. M. & T. Co. to install an electric trolley system to transport the low-grade ores from the fields of Summit county. By the Vidler tunnel the route to the Denver smelters will be shortened by over 75 miles.——H. Davenport has taken a contract for driving the adit on the Vesper group of claims, on McClellan Mtn. The bore is now in 700 ft., two veins having been passed. No drifting has been performed, as it was considered best to intersect the Vesper vein previous to exploiting the ground.——A big force of men is being employed at the Marshall-Russell adit on Silver Mtn. The adit has now advanced 2500 ft., and from surveys the Neef vein should be reached within the next 15 or 20 ft. The company controls all the ground lying along the course of the adit for a distance of 12,000 ft. O. N. Marihugh is manager.——Work has been resumed upon the Scott property, situated on Republican Mtn. Oklun Bros., the owners, purpose running the adit for at least 200 ft. to intersect two known veins. The Scott was a former good producer, but has been idle for the last five years.——Ore production at the Specie Payment mine on Seaton Mtn. has been suspended for a month to permit of the excavation of a station in the Two Brothers adit. At this point a hoist is to be installed, as a shaft is to be sunk 200 ft. below the adit level. This property has been sending out from 1300 to 1500 tons per month, the greater part of the product being sent to various mills for concentration. A. M. Welles, of Denver, is manager.——Report is current that the Argo M. D. T. & T. Co., owning the Newhouse 'tunnel' at Idaho



The Central Part of Colorado.

Springs, will soon start work upon the construction of a smelter with a capacity of 500 tons per day. The plant is to be built not far from the entrance of the 'tunnel' and will be run upon ores from the various mines that are being operated through that bore. What gives credence to the report is the statement that Samuel Newhouse proposes erecting smelters throughout the country that will be equipped with the Fink furnace. This would prove a great boon to the region tributary to Idaho Springs. There are several mines that could furnish from 100 to 200 tons of ore daily, notable among which are the Gem, Sun and Moon, Saratoga, and Old Town.

Georgetown, February 13.

LAKE COUNTY.

Work has been progressing for the last 9 months on the

Bald Mountain adit, at the head of California gulch, by farther advancing the old Garibaldi 'tunnel,' which had been driven and abandoned 25 years ago. The breast of the adit is now 2600 ft. from the mouth, and 780 ft. from the surface, and it is at this point that a seemingly large and valuable deposit of lead ore has been struck. The ore is galena, carrying 65% lead with a good proportion of silver, and the whole deposit is shown to be 12 ft. thick. The ore so much resembles that at the Sunday mine that there can be no doubt of the veins being the same. M. A. Nicholson, W. Morrell, G. E. Keeler, L. A. Reynolds, and Percy Hamm are the directors of the Tunnel company.

SUMMIT COUNTY.

J. Wall, dredgemaster of the *Swan*, has assembled a working crew and is repairing the boats to resume dredging by March 1.——The Reliance dredge, in French gulch, which has been running all through the spell of cold weather, will remain in commission for the rest of the winter, thus demonstrating the fact that dredging can be carried on in the midst of the Rocky Mountains all the year round.

TELLER COUNTY.

Grading has been started near the main shaft of the Golden Cycle Mining Co. for the mill to be erected for the treatment of low-grade mine and dump ores. The mill will have a capacity of 500 tons daily and will adopt a system of dry crushing and screening before concentrating six tons into one. About 330 tons per day are being shipped from the main shaft to the Golden Cycle mill at Colorado City, no damage having been done to either shafts or levels by the so-called earthquake which recently shook up the residents of Independence and Goldfield.——A new hoist and compressor have been installed at the main shaft of the Bonnie Nell Merger Gold Mining Co. on the eastern slope of Raven hill. The 500-ft. shaft has been re-timbered to a depth of 400 ft. below the collar and a new headframe has been erected.——The report of the United Gold Mines Co., issued by the general manager, H. McGarry, shows a balance in hand at the end of the year of over $38,000. There are 28 sets of lessees engaged on the different properties of the companies, and the royalties received from these amounted to $23,130. All the leases have been let with various conditions as to a necessary amount of development to be done, with the result that the whole property is in good shape.



The Copper Region of Lake Superior.

Each rectangle is a township, six miles square.

Key to Mines.

1. Ætna	19. Tamarack
2. Empire	20. Osceola
3. Delaware	21. Tecumseh
4. Amygdaloid	22. Rhode Island
5. Copper Falls	23. Franklin, Jr
6. Central	24. Franklin
7. Phœnix	25. Arcadian
8. Cliff	26. Quincy
9. Mohawk	27. Isle Royale
10. Ahmeek	28. Atlantic
11. Allouez	29. Baltic
12. N. Kearsarge	30. Trimountain
13. Wolverine	31. Champion
14. Mayflower	32. Belt
15. Centennial	33. Adventure
16. Tamarack Jr	34. Mass
17. S. Kearsarge	35. Michigan
18. Calumet & Hecla.	36. Victoria

IDAHO.

SHOSHONE COUNTY.

The stockholders of the Nonpareil Copper Co. have been called on to face the question of raising finances for working the property during the present season. Circulars have been mailed to each with the object of securing their co-operation. According to these circulars the No. 4 tunnel has reached the walls of the vein, and it is expected that only a few feet of advance are required before ore may be broken into. A detailed report of the property accompanies each circular.——The new equipment, consisting of gasoline engine and hoist, etc., recently ordered by the Government Gulch Co., has been delivered and installed, and it is expected that development will be resumed immediately. It is the intention to sink the shaft another 100 ft. and then to explore the vein.——The long adit of the Snowstorm mine in the Mullan district has been driven to within 80 ft. of the vein. This adit is at present 3100 ft. long and is designed to reach a depth of 550 ft. below the present lowest workings. In the meantime the mine is shipping at the rate of 12,000 tons per month. The ore goes to several smelters, and a sample shipment of 500 tons has been made to the Balaklala smelter in Shasta county. There is said to be enough ore blocked out at present to allow steady shipments at the rate of 500 tons per day for the next three years.——Charles McKinnis, manager of the Caledonia mine, where a strike was made at the face of a drift on the 300-ft. level a week ago, has brought to Spokane some samples of ore, which assay from 66 to 334 oz. silver, with lead in proportion. Some of the samples are pure crystallized lead, others are wire silver, and others are chlorides of lead. Experts say that the ore is similar to that found in the Last Chance and the Hercules mines.——Frank Gaffney has just filed applications at Lewiston for mining claims in the Weippe district. William Gaffney and S. P. Fitzgerald are interested in the property, which they have prospected since 1907. The claims are near the 8000 acres of land recently leased for a term of 50 years to G. W. Thompson, who will spend a large amount of money in prospecting the croppings which show hematite ore in payable quantity. Several experts are coming from Duluth in April to make a thorough examination of the district for Eastern capitalists. The lease held by Thompson provides for the payment to the State of Idaho a royalty of 15c. per ton for all ore mined. The timber on the land belongs to the State.——The Great Eastern Mining Co. has just awarded a contract for 200 ft. of cross-cut work on its property on Canyon creek to tap the Cape Horn vein. The property has been extensively developed and some good ore has been opened on the No. 1 vein. When in about 500 ft. the lode was cut by a cross-cut and drifted upon 1700 ft. in an easterly direction. The cross-cut now to be run is from the face of this drift.——F. H. Brownell, of New York, who succeeded Charles Sweeny as president of the Federal Mining & Smelting Co., is at Wallace looking over the properties and becoming familiar with the details bearing on the litigation between the Bunker Hill & Sullivan and the January Mining Companies.

MICHIGAN.

An examination of lode material from the 75-ft. amygdaloid bed disclosed by trenching on the lands under option to the new Baltic Exploration Co. shows all the characteristics of the Baltic lode, and there is little doubt that the northern extension of the South Range lode has been definitely ascertained.——Isle Royale's shaft on the Baltic lode is being sunk below the 110-ft. level, and will soon be deep enough to warrant investigation by cross-cutting.——North Lake has two diamond-drills going through solid rock. No. 2 drill is nearing the eastern standstone.——The Lake Co.'s shaft, 400 ft. deep, is bottomed in rich copper ground. The company is driving a drift at this depth.

The Winona mine is in good shape physically, and already is opened well ahead of immediate requirements. Operations are confined to No. 4 shaft, where driving is in progress on the fifth, sixth, seventh, and eighth levels. The shaft is approaching the tenth level. Eight machine drills are in regular service. The present showing of copper is unquestionably the best in the history of the mine, and compares very favorably with the average rock being mined in the district.——The Ojibway No. 1 shaft shows the Kearsarge lode well mineralized. The mine was cutting a plat when the lode was encountered. The cross-cut at the No. 2 shaft is in about 40 feet and will reach the lode within a week. ——The Wyandot has entered the amygdaloid lode at the 700-ft. cross-cut. There is practically no copper yet showing.

KENT COUNTY.

The long distance electric power line from the Muskegon river to Grand Rapids, holds the world's record for high voltage transmission of electrical energy. This record voltage is 110,000 volts, and it is only a few years ago that the 72,000-volt pressure over this same line was the highest in the world. The wires for this high tension are suspended from steel towers 53 ft. high and 500 ft. apart. They are insulated with five large porcelain discs 10 in. diameter, which are tested to stand a pressure of half a million volts without arcing. A peculiarity of this enormous electrical pressure is to cause a static discharge from the transmission wires into the atmosphere, causing a crackling sound which can be heard for a considerable distance. In the dark this discharge can be seen as a luminous haze around any point where there is an irregularity in the copper wire.

MONTANA.

LEWIS AND CLARK COUNTY.

The new electrolytic plant of the Elkhorn Electrometals Co. has been started, but so far sufficient time has not elapsed to guage the efficiency of the process. The plant is the first one of its kind of commercial size to be erected in the country.

MISSOULA COUNTY.

M. B. Gray, of Trout Creek, who has been prospecting in the district east of the Idaho-Montana line, where he owns a two-third interest in the Monide property, says that his adit is now in 300 ft. on the vein, which has a width of 12 ft. averaging 8% copper. Some of the samples run 5 oz. silver and $16 in gold. A shipment of 1000 lb. sent to the Panhandle smelter for testing returned $23, of which $8.35 was deducted for excess silica.

SILVER BOW COUNTY.

A large number of men have been laid off by the Amalgamated Copper Co. at the different mines, especially at the Anaconda, Boston & Montana, and Butte Coalition mines.

NEVADA.

ESMERALDA COUNTY.

The American Mining Congress is arranging to present forcibly to the Federal Congress at its next session to be held in Goldfield the demands of Western mining men for the amendment of the old and the passage of new statutes regulating mining. This will be done by eliminating as far as possible the undesirable features of the present United States, Mexican, and British Columbian laws, and incorporating all that is good into a new code. The law of the apex will again be brought into prominence; for both Michigan and Arizona have so conspicuously shown freedom from litigation due to not using that law.

HUMBOLDT COUNTY.

(Special Correspondence).—The first carload of machinery for the mill being constructed for a London syndicate has arrived here, and, according to the manager, C. S. Floyd, will enable construction to be completed in about six weeks. The miners of the district are much encouraged, for connected with the mill will be a sampler where ore will be purchased both in small and large lots, enabling local operators to get quick cash returns. Samuel Harris, representing the London syndicate, intends the mill to be one of the finest in the State. All tank foundations and walls are of concrete, and heavy framed structures are being used for upper parts of the buildings. Ore will be treated by amalgamation, crushing to slime, and cyaniding, without any concentration; and as all grades of ore are to be treated, nothing will be shipped except bullion. D. H. Skae, the mill manager, has supplied further details about the plant: the ore will be weighed both before and after being discharged into the 10-compartment bins, which have a capacity of 300 tons. After the second weighing it will be elevated to the top of the Vezin sampler, which will take out 20%. The remainder falls onto a belt elevator which conveys it to the mill-bins, while the original sample is further crushed by rolls, and a tenth part taken out by a No. 1 Vezin as a final sample. The stamp battery consists of ten 1000-lb. stamps in which there is no intention to crush fine. Lip plates are attached to the mortars, and after passing over the amalgamating plates the pulp will be separated into sand and slime by a Dorr classifier. The sand is then to be fed by spiral conveyor to a 16-ft. tube-mill lined with an improved type of El Oro liner; the ground product will be elevated by a Frenier pump to a second compartment of the Dorr, whence all slime will flow direct to the cyanide plant. In the cyanide plant a 25-ft. cone classifier will serve as a de-waterer, the thick pulp being pumped by a Butters centrifugal to the agitators, while the overflow will be returned to the mill-feed. Before introduction into the four Brown agitators, cyanide will have been added, and agitation by compressed air will ensue for about 24 hours. Separation of the gold-bearing solution is to be effected by an Oliver continuous vacuum-filter; and the final stage of precipitation will be accomplished by 16 zinc-boxes. All accessories of the plant are on the same generous scale, and nothing is being left undone to ensure complete success for this new venture of the Seven Troughs district.

Mazuma, February 15.

LINCOLN COUNTY.

On July 1 the bill passed by the Senate for the division of Lincoln county will go into effect. Thereafter Lincoln county will extend as far south as the third standard parallel, all south of which will go by the name of Clark county, with Las Vegas as capital. Lincoln will pay $10,000 to the new county as a proper share for property held by both at Pioche.

NYE COUNTY.

Fresno mining district is the name just given to the country around George's canyon, 40 miles northeast of Tonopah. The new camp is the scene of a rich strike lately made on the property of Stimler & Marsh. H. J. Wildegrube says that the mineralized section of the district extends over a large zone and when several of the properties are opened up the place may prove a valuable asset to Nye county. During the past week the MacNamara mine in Tonopah shipped 200 tons of ore to the Montana mill for treatment. The shipment was less than that of the previous week owing to work at the bottom of the shaft preparatory to sinking, which has been started. The shaft had to be timbered near the bottom, and now that this has been completed the work of sinking will be continued a farther 300 ft. to prospect some veins formerly cut by the diamond-drill.——Edgar A. Collins is working on a system

for treating the concentrate of the Montana-Tonopah mill instead of shipping them at heavy freight and treatment cost. The Hutchinson process, used so successfully on the ores of the Goldfield Consolidated, will not economically treat the Montana ores, but it is possible that a modification may be introduced to suit the Montana conditions.——The MacNamara Mining Co. declares its intention of disbursing $10,000 in dividends on the first of each month, beginning on March 1. There is also talk of constructing a mill, as the company's contract with the Montana expires in the middle of March.

STOREY COUNTY.

The first dividend to miners from the proceeds of the ore taken from the Ophir and Consolidated Virginia for the past three months has just been distributed. It amounts in all to $1956, and has been distributed according to the wage earning capacity of the different men employed. The idea of the management is that when men are working on shares and know that they are to get a part of whatever the mine produces they will be more diligent in their daily duties and use every endeavor to do the best for the mine.——The Comstock Goldfield Leasing Co. is operating at a place about a mile east of Virginia City, and has mined silver ore of notable value, which is being shipped to Selby's at San Francisco by the superintendent, Joseph T. McCarthy. Previously it had been sending the output to the Butters plant in Six-Mile canyon, till the value of the shipments justified sending the ore down to the city.

WHITE PINE COUNTY.

A high-class fire-clay deposit has been found on the Haberson ranch, and a contract has been signed with the Steptoe Valley smelter to supply 100 tons per month, as it is fully equal in quality to that brought in from Ogden.

OREGON.

UNION COUNTY.

Ten stamps will be installed at the Humboldt mine in Mormon Basin, owned by the Humboldt Gold Mining Co. The shaft is down 200 ft., at which point a second station will be cut and drifts will be run.——W. L. Vinson is completing a deal by which he will dispose of his interest in the Intermountain group, better known as the Wagner property, in the Mormon Basin district, 35 miles east of Baker City. It is understood that Vinson's controlling interest will be sold to C. E. Bond, Andrew Hawkins, and J. W. Howser, who are all from Kentucky. They appear to be pleased with the property.

UTAH.

SALT LAKE COUNTY.

Dr. A. Penck, professor of geology at the University of Berlin, in a lecture to the mining students at the University of Utah, congratulated them on being trained in a region so rich in geological features. For not only does the Utah Basin contain ancient shore-lines, glacier deposits, faults, alluvial fans, etc., but the neighboring hills offer the students a varied field in the study of ore deposits and practical mining.

WASHINGTON.

FERRY COUNTY.

Work has been resumed on the San Poil mine in the Republic district, north of Spokane, after a shut-down of more than a year. George James has taken a year's lease on the property, which is the best known in that camp. It is opened by an adit to the 300-ft. level and has over 700 ft. of drift. A raise has also been made from the 300-ft. to the 200-ft. level. The average value of the ore is placed at $15 per ton, and is three feet wide.

CANADA.

BRITISH COLUMBIA.

Official announcement is made by C. H. Dickie, of Victoria, that the Portland Mining Co., of which he is president, will install a smelter and an aerial tramway on its property, upon which more than $50,000 has already been spent in development work. The company is a reorganization of the Portland Canal Mining & Development Co. and is capitalized for $1,000,000 in four million shares of 25c. each. The property consists of 12 claims at the head of Portland Canal, formerly known as the Missouri Stewart, and shows a well-defined silver-lead vein on six of the claims. W. J. Elmendorf, a mining engineer of Spokane, who examined the property, states that there are more than 20,000 tons of ore available.——The plant of the Canada Zinc Co. at Nelson has been five years in arriving at its present stage and represents an outlay of nearly $125,000, of which the Provincial Government advanced $20,000. The smelter has a capacity of 10 tons per day at present, but now that it has passed the experimental stage the capacity will be increased to 30 tons per day. The ore so far treated has averaged 40% zinc, 10% lead, 12 oz. silver, and 1 to 5% copper per ton. A vertical furnace, heated internally by electricity is used at this smelter. The electrical heating does away with the horizontal retorts commonly used in zinc smelting, and much labor and breakage is also saved. At the other smelters of the district, zinc has been penalized, as the zinc oxide residues tended to block the flues. Now that both lead and zinc can be treated together there will be quite a stimulus to production in the Nelson and Kaslo districts.——Great interest is being taken in the recent discoveries of copper-bearing ores in the vicinity of Vancouver.——The West Canadian Placer Co. has been formed with a capital of $75,000 to acquire an option on the Turner mining lease in the Cariboo.——A big deal in mining property has nearly been accomplished in northern British Columbia. The vendors are a syndicate composed of William Noble, W. H. Collison, John Flewin, and a company known as the Alaska Smelting & Mining Co., the first three named being the vendors of the larger part of the porperty. The purchasers are the Associate Mining Co. of London. The deal has been brought about for the company by Cecil M. Bryant. The properties comprise about 40 claims situated on the east side of the Portland canal, 70 miles north of Port Simpson, at a place designated on the map as Maple bay. Considerable development has already been done at the mines, and 12,000 tons of ore have been shipped up to date.——A reorganization committee for the Dominion Copper Co. has been formed by the leading bondholders and stockholders, comprising Charles Hayden, of Hayden, Stone & Co., chairman, W. W. Foster, John A. Sleicher, Warren Curtis, Channing Stebbins, James Williamson, and Henry H. Melville. The Dominion Copper Co., now in the hands of the court, has outstanding $800,000 of bonds, with $28,000 of unpaid interest thereon, $100,000 of floating debt, and 50,000 shares of stock, par $10. The reorganized New Dominion Copper Co. will issue $500,000 of 6% ten-year income bonds, 250,000 shares of common stock of a par value of $5 per share. It is announced that should a large amount of additional capital be necessary to develop the properties and construct smelters, etc., it may be found advisable to sell the property rather than take the chance of continuing at a loss.

ONTARIO.

The constant improvement in the position of the silver market will prove an important factor in the dividend returns of the Cobalt mines during 1909. The advance in the price has been about five cents an ounce from the low level of last summer, when China was a heavy seller of silver. The advance of five cents an ounce means an increase in the value of the Cobalt output of nearly $1,000,000, taking last year's production of about 19,000,000 oz. as a basis. This would be over 2% on the entire capitalization of the dividend-paying mines. Many silver experts expect that a price of 60c. an ounce is among the probabilities of the year.——Cobalt Central has made some rich silver discoveries at a depth of 400 ft. under Diabase Mtn.; and is at a greater depth than any other mine in the region except the Jacobs on Kerr lake.——During January the Nipissing Co. mined ore of an estimated value of $128,000. Important development work was done on the 130-ft. level of the Fourth of July shaft, as a 1-in. vein has been followed across a fault, and found to be 6 to 8 in. wide, carrying on an average 3000 oz. silver per ton.

Special Correspondence.

LONDON.

Radium Minerals.—Venture Corporation.—Broken Hill. — Engineers Club.—South American Mining.—Associated Northern Blocks.

It has long been felt by the leading members of the Institution of Mining & Metallurgy that mining men are in want of greater facilities for social intercourse than their Institution can, from its nature, afford them. The founding of an engineers' club has always seemed a desirable innovation, and the time is now ripe for doing something of this sort. As a means of sounding the profession as to the requirements and possibilties, a number of leading men have called a meeting for January 28, to be held at the Waldorf hotel in the Strand, and have invited members of the Institution to attend. The proposal is that a meeting of this sort be held once a month, when members can discuss matters of general interest and the papers read at the preceding meeting of the Institution. The meeting will not be formal. No reporters will be present, so that men will feel free to exchange views. The meetings of the Institution are held at the rooms of the Geological Society, and at the entrance is a notice prohibiting smoking on the premises, a fact which gives many men the impression that the meetings are solemn and unsympathetic. At the proposed club assembly smoking will be allowed.

Radium mining is a small industry at present and it is not safe to prophesy its future; nevertheless, everybody who knows anything about pitchblende is turning over his dump and examining his stopes. The inclination to do this has received a fillip lately by the announcement that a Radium Institute is to be founded in London. The English medical men have become convinced that certain of the emanations of radium and its compounds are efficacious in treating skin and other diseases and they have received the financial support of Sir Ernest Cassel and Lord Iveagh, two millionaires who are continually giving liberally toward medical research and other objects for the improvement of social conditions. At the present time there is a radium institute in Paris where research and hospital work are carried on, and in Vienna a laboratory for research work only is being erected. At the London institute both paying and poor patients will be treated, and research work carried on. As regards the source of radium, efforts are being made to utilize the pitchblende that exists in Cornwall. For many years the sole commercial output of this mineral came from the Uranium mine, which is situated between Truro and St. Austell. In 1907 the output was 71 tons and probably the figure for 1908 will be similar. Some of it is treated in London and some in the pottery district of Staffordshire, but the bulk goes to Germany. The uranium products obtained from it are used for coloring glass and pottery enamels, and in photographic work. A year or two ago the owners of the mine tried to raise money to treat the ore on the spot and to extract radium from the residues, but this scheme fell through. At the present time another mine, the Trenwith, near St. Ives, is being opened up for pitchblende. The mine belongs to the St. Ives Consolidated, a company formed by the Messrs. Schiff some months ago to acquire a number of old tin mines in the neighborhood. In the stopes and on the dumps are found quantities of pitchblende, which in the old days was left untouched or sorted out. A subsidiary company, called the British Radium Corporation, has been formed to deal with the pitchblende and produce radium from it. Sir William Ramsay has examined the mineral and has reported favorably on its radio-activity. Pitchblende is found in a great many other mines in Cornwall, but not in commercial quantity.

I recorded some weks ago that the Venture Corporation had been successfully reconstructed under the name of the London Venture Corporation and that the outlook for its future seemed promising. The statutory meeting of shareholders in the new company was held this week, when it was announced that the subscriptions had come in well. Besides the 300,000 fully paid 4s. shares, approximately 400,000 had been alloted with 2s. credited as paid. In addition, 2007 shares had been subscribed at par (4s.); so that altogether the new company starts with a cash capital of £40,400. The chairman, F. W. Baker, took the opportunity of sketching an outline of the company's projects and policy. One item of news is that negotiations are pending whereby additional capital will be subscribed in America by parties whose names are not yet divulged, and that the company is to have offices in New York and Chicago, where its interests will be looked after by local representatives. A property in New Mexico, where a 40-stamp mill is being erected, is to be examined with a view to purchase, also a gold gravel property on the Atrato river in Colombia. Oil-lands in a French colony, mineral lands in a State of Central America, and a mineral estate in South Africa were also mentioned. Perhaps this information may be supposed to be too vague for recording here, but at a statutory meeting of a company like this it is not usually considered good policy to give details of deals that have not yet been consummated.

Six months ago, when referring to the effect of the slump in metals on the Broken Hill silver-lead district, I mentioned that Block 14 Company had found it necessary to shut-down their sulphide mill entirely, as their ores are not quite so rich as those found on some of the neighboring properties. The mill is still idle, but other work is not in abeyance. Development of the orebodies continues and considerable quantities of the carbonate ore in the upper levels is still being mined and sold to the Broken Hill Proprietary. For instance, during the six months ended September 30 last, 15,525 tons of carbonate ore was disposed of in this way, as compared with 13,762 tons during the half-year before. The average content of this ore was 33% lead and 12 oz. silver, representing 5159 tons of lead and 189,342 oz. silver. The price obtained was £40,639. This part of the mine continues to open up well and there is about six months' supplies ready for stoping. As regards the sulphide ores, it is estimated that above the 600-ft. level the reserves amount to 220,000 tons averaging 12% lead, 8½ oz. silver, and 9% zinc. The expenditure on mining, development, maintenance, and provision for depreciation comes to about £38,000. The balance in hand now amounts to £85,000, and the company is only waiting for a rise in metals to go ahead successfully.

In my last letter I referred to the proposal to start some sort of a club for mining engineers in London. The inaugural or experimental meeting was held on January 28 and proved a great success. There was a large attendance in spite of one of London's densest fogs, and the proceedings were thoroughly enjoyed. It was decided to go ahead and the committee was asked to formulate further proposals. A good deal of time was occupied by an informal discussion on H. W. Hixon's paper on the genesis of ore deposits, read at the January meeting of the Institution of Mining & Metallurgy. Speeches were limited to ten minutes and they were both lively and pointed, a great many of those present participating. As regards the future meetings of the club, it is felt that it will hardly be good policy to discuss papers read at the Institution's meetings, because it would tend to lessen the interest of the regular meetings. The readiness of members to talk at the club meeting as compared with their diffidence at the Institution's meeting indicates that many would purposely postpone their remarks. This would not be fair or good policy.

On previous occasions I have referred to the inclination of promoters and mining men to introduce South American propositions to the investing public. An interesting example is to be found in the Rio Del Oro Co. Ltd., which has just been floated to acquire dredging and gravel concessions in the river Yuruary in Venezuela. The promoter is H. E. M. Bourke and with him are associated as vendors Gerald Browne, of the firm of Pearse, Kingston, & Browne, mining engineers, and N. G. Hackney, also a mining engi-

neer. All these gentlemen are intimately acquainted with the property, and their views and opinions are endorsed by Frank Merricks, of the firm of Merricks, Crane & Co., who made an independent examination. The river Yuruary has long been known for its auriferous gravels, and the concession acquired by this company is additionally interesting owing to its being situated just below the famous El Callao mine. This mine has in its time produced great quantities of gold, and the whole of the tailing from the batteries was discharged into the river. Records show that 1,500,000 oz. were extracted from 700,000 tons of quartz, and that the tailing averaged 9 dwt. per ton. No attempt was ever made to recover the pyrite from this tailing or in any other way to extract the gold contained in them. To re-treat the accumulation of tailing is one of the objects of the Rio Del Oro Co. The vendors and Mr. Merricks give very full information relating to the banks of gold-bearing gravel, and altogether the enterprise is attractive.

A year ago Hermann Landau, chairman of Associated



Map of Arizona.

Northern Blocks, one of the mines at Kalgoorlie, lamented that the mine showed signs of exhaustion and that the company was unable to carry out extensive exploration in depth. Indeed, it was on this occasion that he startled the world by suggesting that deep exploration should be undertaken by the Government out of the public funds. At adjoining mines, such as the Great Boulder Proprietary and Lake View Consols, good ore has been struck at lower levels than was generally expected, and it was hoped that Northern Blocks would do likewise. However, no such work has been deemed advisable by George Roberts, the manager. Further disappointment ensued in opening up the ore reserves. In several parts of the mine the grade has been found to be much lower than was anticipated, and the recovery has fallen considerably. A year ago it was estimated that the reserves would last three years and would yield 12 dwt. per ton. At the present time Mr. Roberts is having to work 8-dwt. ore, and does not feel sure that the reserves will last for much more than a year. The directors are now casting about for a new property. They tried the Southern Cross without success, and are now developing Harbour Lights, though they are not hopeful about it. Arrangements are now being made to extend the field of operations outside Western Australia. The company is in a strong financial position, for it has a reserve fund of £130,000 invested in Government securities. During the year ended September 30 last, £87,500 was distributed in dividends. Altogether, gold to the value of £1,397,812 has been recovered from 226,681 tons of ore since the mine commenced operations.

NOGALES, ARIZONA.

Sale of Pilares.—Geology of Santa Cruz District.

The rumored sale of the Pilares mine in the Santa Cruz copper district of northern Sonora, to Greene-Cananea interests, through W. C. Greene as agent, marks the commercial result of a development enterprise which began about December 1906. At that time Eduardo Arnold, mayor of Cananea, a Mexican citizen of Swiss descent, began to develop a copper prospect in the foot-hills of the southwestern slope of the Santa Cruz mountains, a low range forming the geographic and geologic continuation of the Patagonia mountains of Arizona. The presence of copper at the point where development was begun was suggested by slight green stains of malachite or dioptase on the surface outcrops of the country rock, and some earlier prospector, in sinking two shallow holes, had encountered some small stringers of chalcopyrite. Mr. Arnold, with the spirit of adventure so necessary in developing prospects, sank a shaft near the old prospect-holes, and, soon encountering a substantial mineralization of chalcopyrite, drove a tunnel to meet the shaft from the bank of an arroyo about 100 ft. below. He has since continued the development to a depth of 400 ft. with satisfactory commercial results.

A brief reconnaissance of the geology indicates that the country rock is largely quartzite, intruded by a coarse grained eruptive, probably mica-diorite, and cut by dikes of quartz-porphyry and andesite. A substantial dike of the latter is near the orebody and may have been the exciting cause of the mineralization. The copper ore is chalcopyrite, with small amounts of secondary bornite and occurs either in the quartzite, filling interstices and crevices, or in a quartzose gangue which has some characteristics of the filling of a fissure vein, but is more probably a segregation.

The orebody has widths ranging from 15 to 30 ft., has been opened for some distance along the vein, and is said to average considerably over 8% copper. A striking feature is the very slight surface indication of the presence of this deposit, but it is also true of the larger orebodies at Cananea that they did not underlie the strongest gossans and were chiefly found by blind driving. Obviously, gossans come from the decomposition of metalliferous deposits, and if the surface erosion has not reached their upper limits, no gossans can be exposed.

On account of this mine being within 50 miles of Cananea and within three miles of the railway recently constructed between that city and Nogales, the ore will be of great value to the Greene-Cananea company as a source of silica. At the time when substantial bodies of chalcopyrite were first found in the Pilares, some excitement arose in the neighborhood and many denouncements were made on the ground surrounding that of Arnold. Colonel W. C. Greene took up 4000 pertenencias, but this area was subsequently greatly reduced and his claims are now being prospected by the Greene-Cananea people. Little development work has been done on the other claims in the vicinity, chiefly for lack of funds; as yet, outside of the Pilares mine, little is known as to the possibilities of the locality, although chalcopyrite has been found on neighboring properties. The chalcopyrite is probably a secondary enrichment and, so far as one may judge from available information, no one may now venture an opinion as to whether this zone of enrichment extends to great depths, or whether it will soon give place to a leaner primary ore. At many points in northern Sonora, the primary copper ore is found to be iron pyrite carrying 2 to 3% copper. In semi-arid countries the fluctuation in ground water-level is excessive, sometimes having a range as great as 150 ft., and this occasions great irregularities in the resultant phenomena of secondary enrichment.

CHICAGO.

Oil Production.—United Mine Workers. — State Geologists. — Electrical and Automobile Shows.

Oil production in Illinois continues to increase. Early this month the Ohio Oil Co. announced it would take 80%, instead of 60% of the output. This, with the 5800 bbl. that the independents handle, makes practically 100,000 bbl. per day now being run. Even at this rate it will take some weeks to relieve the congestion and run off the accumulated stock in producers' tanks. Several months will elapse before the Tidewater line from Rixford, Pa., to Robinson, Ill., is completed. Approximately 300 miles remain to be constructed. Both the pipe and telegraph lines have been finished from the east into Ohio and at the west end from Robinson into Owen county, Indiana. Five gangs of men are being used and the work is going forward steadily despite winter weather. The line is expected to be ready to take oil this spring. While local producers have got along well with the Standard and there has been an entire absence of the friction that has characterized the development of so many oilfields, an independent outlet will be welcome because of the increased production possible. Small oil-wells continue to be brought in at various points in the western part of the State, but the field is still uncertain. The *Oil Field News* has been established at St. Louis to cover this territory.

The United Mine Workers had a lively session at Indianapolis, but apparently the different factions have agreed on a working program and intend to present a united front. The re-election of Tom Lewis as president was at first sharply contested by J. H. Walker, who led in severe and bitter attacks on the administration. Eventually, however, he withdrew from the contest. No candidates having received majority votes for vice-president and secretary-treasurer, the election was thrown into the convention, with the resulting selection of E. S. McCullough for the first-named office and Edwin Perry for the second. Mr. McCullough was born 41 years ago in Ohio. Like many of the miners' leaders, he is self-educated and is a socialist. He has been president of the Michigan miners. Mr. Perry is a Welshman, having been born in north Wales 54 years ago. He, however, came to the United States in 1869 and has worked both in the anthracite and bituminous fields. He comes to his new office from Iowa. Messrs. Lewis, McCullough, and Perry will be the official heads of the largest labor union in the country and a most powerful factor in one of our basal industries. Whether they will at the same time become real leaders, it is too early to say. Many informed observers doubt the ability of Lewis, in particular, permanently to hold the organization together, and it was demonstrated at Indianapolis time and again that John Mitchell is still the most popular leader in the organization.

Interest in coking of Middle West coals continues to increase. It is announced that the H. C. Frick Co. is to build a bank of by-product ovens in the Chicago district in place of enlargements at first contemplated at Connellsville. A number of other concerns are quietly looking into the situation and it will probably not be long before a beginning is made.

It is announced that L. P. Breckenridge, professor of Mechanical Engineering, and director of the Engineering Experiment Station at the University of Illinois, will go at the end of the year to a similar position at his alma mater, Yale. Professor Breckenridge has been an active factor in the development of better uses of Illinois coal and his going will be a distinct loss to the State. In Indiana a bill has been introduced in the House to abolish the office of State Geologist, but it is not likely to pass. Despite the peculiar organization of the department in Indiana, it being frankly political, the present State Geologist, Mr. Blatchley, has done good work.

The annual succession of shows at the Coliseum is now on. Last week it was the electric show, now the automobile, and soon the cement products exhibition is to follow. It is hard to estimate the importance of these annual exhibitions, but they seem to have become a fixture and undoubtedly have a broad educational influence. Necessarily, they are arranged to interest the average householder and citizen, but there are always a few things of especial import to mining men. At the electrical show, aside from mine telephones, cables, lamps, and motors, there was an exhibit by the Northern Electric Mfg. Co. of a new electric rock-drill. The drill is of the high-speed hammer type, the blow being given by a rotating helve carrying two hammers, cushioning on air. The mechanism is ingenious and offers distinct possibilities. The type shown impresses one as too bulky and heavy for most underground work, but it ought to be possible to re-design the machine to meet special conditions. In its present form it is better adapted to quarry work. It has been tried in the zinc mines of Wisconsin with some success. The automobile show contains much of interest to mining men, though in general the types shown are adapted more to city and suburban use. The Illinois Society of Engineers and Surveyors held a successful meeting at the Great Northern the last of the month.

TORONTO, CANADA.

Railroad to Gowganda. — Developments at Cobalt. — Government Royalties.—Conviction of Mine Promoter.

The new silver camp at Gowganda is now accessible by rail, a daily service having been established with Toronto. The sleigh and wagon-road from Sellwood, the end of the line north of Sudbury, having been completed, the first train from Gowganda left this city on February 2 over the Canadian Northern railway. On reaching Sellwood by way of Sudbury freight and passengers are forwarded to their destination by the conveyances of the Gowganda Transport Co. A party left this week for a trip of inspection, among them being J. B. Tyrrell, J. C. Murray, and J. W. Bartlett. Arthur Hawkes, the publicity agent of the Canadian Northern, has extensive projects in view in connection with the development of the region. At Gowganda great activity in building prevails, and freight and materials are being rushed in. Discoveries are daily reported, and claims are changing hands at high figures. It is impossible to verify these statements, many of which are doubtless exaggerated, but there is no question as to the rapid development of the camp.

The depression in mining stocks continues, notwithstanding the heavy shipments, and the respectable dividends paid by the leading Cobalt mines. The market has been flat since the middle of December. The most noticeable feature during the last few days has been the break in Silver Queen. The shares which had been fluctuating between 90 and 100 suddenly fell about 20 points. The only apparent reason was a rumor that the dividend might be passed, which was contradicted today by an official statement that the cash is now in hand for its payment. Other companies, chiefly of the non-dividend paying class, have also materially weakened. One cause of the depression is no doubt the Gowganda and Montreal River booms, and the numerous new flotations, either actual or prospective, which are absorbing the attention of investors to the detriment of the older issues.

At the Nipissing Fourth of July shaft at 135 ft., three new veins, two 1 in. wide and one 4 in., yielding 4000 oz. per ton, were recently found. At the Silver Bar the original shaft has been abandoned and two new ones started, in both of which good ore has been developed. One of them is down 90 ft.; the other has reached a depth of 30 ft. on a 3-in. vein showing native silver. Latest developments at the Crown Reserve indicate that its position as a prominent shipper is likely to be maintained. No. 1 shaft, which is 100 ft. deep, and No. 2, now down 145 ft., are both to be sunk to the 200-ft. level. They were recently connected by a drift, in both floor and roof of which the vein is 16 in. wide, and very rich. In addition to drifting on the main vein, a cross-cut has been driven some 200 ft., and a num-

ber of smaller veins showing good silver content have been revealed. Development has been temporarily suspended at the Colonial mine for the erection of a stamp-mill and concentrator, the mine having large deposits of low-grade ore. The smelter of the Montreal Smelting & Refining Co., at Trout lake near North bay, is now in active operation and has received large consignments of ore from the Temiskaming and McKinley-Darragh mines. The La Rose is shipping high-grade ore taken from the raise at the 200-ft. level. The vein is 11 in. wide, containing cobalt and silver with a little calcite, and the wall-rock is heavily impregnated with native silver. The value of the high-grade ore reserves at the Temiskaming & Hudson Bay is estimated at $1,500,000. The main shaft is to be sunk from 200 ft., the present depth, to 250 ft. The O'Brien mine has paid $49,518 to the Ontario Government, being 25% royalty on the output for the last three months of 1908.

The annual meeting of the shareholders of the Dr. Reddick mine, one of the most hopeful of the Larder Lake enterprises, was held at Ottawa February 1. It was decided



State of Jalisco, Mexico.

to increase the capital to $2,500,000 by the issue of $500,000 in 8% cumulative preference stock. The superintendent's report showed that the first 30 tons milled yielded $8 worth of gold per ton, and the next 100 tons between $10 and $12 per ton.

Frank Law, a mining promoter and broker, accused of conspiracy to defraud in connection with the Highland Mary, Blue Bell, Lucky Boys, and other flotations, was brought to trial here last week and found guilty. The evidence showed that Law and his confederates had received subscriptions amounting in all to about $250,000 for the shares of these worthless concerns. Law's defence was that he had been promised immunity for information in the extradition proceedings against W. Lockhart Russell, alleged to be the leading spirit in the fraud. Sentence has been deferred, Law having taken an appeal on the ground of his having been used to assist in the proceedings against Russell. It is said that Russell has at last been discovered somewhere on the Pacific Coast, and that the extradition case would be proceeded with, but up to the present he has not been apprehended. Law appealed, but his appeal was denied, and he has been sentenced to five years imprisonment. He evidently still entertains hopes of escaping or of a mitigation of the severity of the sentence, as he is now going over the books and papers of his companies with the officials, for the purpose of saving something out of the assets, wherewith to make restitution.

GUADALAJARA, MEXICO.

Navidad Mines. — Amparo Dividend. — New Plant at Tenemache.— Lawson Development Company.

California men who are interested in the Navidad Mines & Reduction Co., operating in the San Sebastián district of Jalisco, are preparing to furnish electric power to mines and mills in that and adjacent districts. They have secured a concession to use the water of the Ameca river, and have planned a hydro-electric installation capable of producing 5000 hp. The power will be transmitted as far as the Compostela district of Tepic, where some of the men of the Navidad company are also interested. S. C. Irving, president of the Paraffine Paint Co., of San Francisco, is president of the company, and R. S. Penniman, manager of the Pacific Coast department of the Du Pont Powder Co., and H. H. Tracy, of the Tracy Engineering Co., of San Francisco, are among those heavily interested. The California men bought the mines from a Mexican company about two years ago, the contract price being ₱300,000. They will soon replace the existing reduction works with a modern plant, and will give the mines connection with the Pacific port of Las Peñas by the construction of a wagon-road. Messrs. Irving, Penniman, and Tracy recently visited the Navidad properties. The Amparo Mining Co., of Philadelphia, operating in the Etzatlán district of Jalisco, is again on a dividend-paying basis, the directors having declared one of 2½%. It is announced that this will be paid quarterly, making an annual dividend of 10%. The quarterly dividend amounts to $63,000, and the capital stock on which it is paid is $2,520,000. Two years ago the company paid a dividend of 3%. The affairs of the Amparo company, which for nearly a year have been in charge of James H. Howard as general manager, are in excellent shape, and it is believed that from now on dividends will be paid regularly. The production amounts to about ₱30,000 per week.

The Tenamache Mining Co. of Guadalajara has just placed an order for reduction machinery for the Tenamache mines at Zopilote, Tepic. The order covers 10 stamps, re-grinding machinery, concentrators, cyaniding equipment, boilers and engine, and electrical equipment. The machinery will be delivered at the Pacific port of San Blas in time for its transportation to the mines before the opening of the next rainy season. The mines, which are *antiguas*, have been under development by the present American company for nearly two years, and a large tonnage of milling ore has been blocked out.

Thomas Kelly, president of the National Livestock Commission Co. of Chicago, F. H. Morley, of Denver, and John A. Kruse, of Chicago, have just completed an inspection of the Ojo Verde copper property in the Autlán district of Jalisco. They were accompanied on the trip by S. F. Ossolinski, who secured the Ojo Verde for Mr. Kelly last year. Plans for extensive development are being formed. The Ojo Verde is an immense virgin deposit, and the property has been 'denounced' for a distance of nearly a mile.

Frank W. Page, general manager for the Lawson Development Co., states that arrangements are being made to carry out the plans made by the company early last year. The custom reduction plant of the San Gerónimo hacienda in the Mascota district of Jalisco will be completed, Mr. Page says, and work will be resumed at several of the company's properties. The purchase of mines on which options were secured last year will be taken up a little later. Mr. Page recently returned from Boston, after a conference with Thomas W. Lawson. Ore assaying 212 gm. gold and 300 gm. silver per ton has been found in the mines of the Quien Sabe Mining Co. at Ajijic, Jalisco, on the northern shore of Lake Chapala. The rich ore will be sacked for shipment. Development has been in progress in the Quien Sabe mines for several years, and a modern reduction plant has been erected. Patrick E. Blalack, of San Antonio, Texas, and C. H. Maris, of Brownsville, Texas, are the principal shareholders in the company.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Ice, on melting, yields five times as much water as an equal bulk of snow.

Platinum vessels are attacked to an appreciable extent by fusing borax in them. It has been determined that 200 gm. of borax fused in a platinum dish will take up as much as 0.46 milligram of platinum.

Borax and fluorspar should not be used together in fluxing gold and silver precipitates. The two are mutually destructive, and give rise to bubbling from the evolution of boron fluoride, and that in turn causes loss from 'dusting'.

Uranium may readily be extracted from pitchblende by calcining the pulverized mineral with sodium carbonate, and leaching the fused mass with hot water, and then, with sulphuric acid. The uranium will pass into solution and may be precipitated as hydroxide by ammonia.

Stream piracy is a name given to the phenomenon occurring through the erosion of one stream across the water-parting into the drainage basin of another stream, diverting the latter into the new channel. Valleys are often left thus robbed of their original streams, and what were formerly water-gaps through mountain ranges are converted into wind-gaps.

Ferrosilicon slowly decomposes, the carbon, phosphorus, and arsenic present yielding arseniuretted hydrogen, phosphoretted hydrogen, acetylene, hydrogen disulphide, and hydrogen. It is said that one ton of ferrosilicon will spontaneously give off about 12 cu. ft. of such gases in 24 hours. On this account it renders the atmosphere dangerous when stored in close quarters.

Tube-mills will crush dry or wet. For cyanidation there are reasons why dry crushing would give superior results. Rolls also are efficient dry crushers if the attempt be not made to reduce the material too far. The average maximum size of the ore fed should not be reduced finer than one-third that diameter. Rolls cease to be economical crushers below about 2 mm. diameter.

Self-shooter is the name for an automatic device for clearing sluices of the accumulated boulders and debris. Water is allowed to accumulate behind a small dam. When this is full, some water flows down a pipe into a barrel suspended at one end of a lever, the other end of which is connected with the gate. When the barrel is filled, the gate is raised automatically, and releases the accumulated volume down the race and flume, effectively clearing away all boulders and tailing.

Dynamite rapidly deteriorates in water by solution of the sodium nitrate employed in the 'dope'. The 'dope' of ordinary dynamite consists of wood-pulp, to which enough sodium nitrate is added to supply oxygen for its combustion. As soon as the nitre has been dissolved the 'dope' ceases to hold the nitroglycerine as a uniform mixture, the nitroglycerine leaks out, a miss-fire is liable to occur, and free nitroglycerine will be left behind, which is many times more sensitive to explosion by shock than dynamite.

Sizing tests are not referable to any standard sizes of screens in America, hence a screen-analysis has no significance unless the diameter of opening and of wire are both stated, together with the method of screening, whether wet or dry, and the kind and number of shakes given. Standardization of screen analysis has been introduced into cement-testing, and a very unscientific order of mesh-sizes has been adopted as standard by the Institution of Mining and Metallurgy.

Peat is being used to a larger extent each year in Europe, owing to the growing cost of coal. In America it has not met with favor, owing to the many inconveniences attendant upon its use. For domestic purposes it is objectionable on account of the large quantity of ash produced, and the necessity for maintaining a brisk fire. It will not make a 'banked fire' like coal. For boiler firing, using automatic stokers, and water-flushing of the ashes, it is a satisfactory fuel.

Cement clinker is unaffected by moisture, and clinker that has been stored for some time produces superior cement to that fresh from the kiln. It is not improbable that it will become customary to establish grinding mills in important centres of consumption for cement, so that clinker may be purchased and ground on contract as required. This will effect great economy, and will insure freedom from adulteration and the working off of poor cement as largely practised today.

Cyanimide is a compound having the formula $CaCN_2$, formed by passing nitrogen over calcium carbide at a high temperature. This substance, by melting with appropriate fluxes, produces potassium or sodium cyanide; acted on by steam it yields ammonia; and it is used directly as an efficient aid in the tempering of steel. Its chief use is as a fertilizer, as which it is equal to Chile saltpetre. It can be cheaply produced wherever water-power is available at moderate cost. Cyanimide works of large capacity are being erected in all parts of the world.

Desilverizing of lead bullion is usually done by the addition of zinc to the molten lead. Granulated zinc is placed in a basket of iron wire-cloth, and immersed in the kettle of lead; the bath is then stirred, and the zinc alloying with silver more readily than lead, and being of lower specific gravity, rises to the surface as a scum or 'crust', carrying the silver with it, The 'crusts' are skimmed off and 'liquated' by heating in a form of reverberatory furnace with an inclined hearth, the lead being thus drained from the zinc. The crusts are then distilled in a graphite retort, to drive off the zinc, leaving a base silver residue, which is melted and refined.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

A Valued Subscriber.

The Editor:

Sir—Enclosed please find the sum of three dollars in gold dust for which you will place to my account and renew my subscription when due. I send now, as it takes a long time for a letter to reach San Francisco from here, and I wish to be on time so as to keep the MINING PRESS coming right along.

LEWIS LLOYD.

Shungnak, Alaska, September 10.

[The 'dust' consisted of a number of small flat nuggets weighing about 3 dwt.; the latter had been four months on the way, but it was welcome as evincing the usefulness of the PRESS to those who live on the outposts of empire.—EDITOR.]

Protection of Investors.

The Editor:

Sir—The reported discussion by the Mining & Metallurgical Society of America of provisions for the protection of investors in mining properties seems, to me, to have one serious deficiency, in that it deals chiefly with established mines having ore reserves, which can be measured or estimated.

This is the class of properties most interesting to the mining engineer, and if these were the only properties offered to investors the assumed task of the Society would be simple, but unfortunately this is not the case. For every established and paying mine whose stock is on the market there are at least 1000 that are trying to become established, and for every property with enough ore developed to justify the erection of a reduction plant on the smallest scale, there are probably 500 in which no commercial orebody has yet been found. All of these mining properties need money with which to operate, and their stock is on the market, not necessarily in the exchanges of the large cities, but is being offered to private individuals throughout the country. Further, no effort is spared to sell this stock, for the sales-agent receives a commission of from 25 to 50% of the money he secures for the company. Many and crafty are the ways in which these sales-agents operate. A fruitful method of raising money is by selling stock in small quantities among poor people. Women sell stock to factory girls, saleswomen in stores, to waitresses, chambermaids in hotels, and to other wage workers. Clever tongued men sell stock among farmers, and other residents of rural communities. Sometimes physicians and dentists are led to solicit subscriptions among their patients, and even retired clergymen from former members of their congregations. By exhaustive methods of securing information, trustees of estates are found in country towns, and if they are amenable to argument, are bribed to invest a part of their trust funds in the stock of certain supposedly meritorious mining companies. Again, bank presidents or cashiers in country towns are sometimes approached, and by the donation of a block of stock are led to recommend the investment to some of their more affluent depositors. Of course such work as this must be handled by skilful men, and commands a good remuneration. Ethically the objection to these methods is that the agent is often wholly ignorant of the merits of the property or its proposed management and so, proves, in many cases, to have been guilty of obtaining money under false pretenses.

So much for the dangers which beset the investor in deciding upon a purchase of mining stock. He is not, usually, so fancy free as the lady who chose a certain mining stock as an investment because its color matched that of her hand-bag. His troubles, however, are not yet over with the consideration of the character of the property. The general question of administration is still before him, and is a fruitful source of danger. Without going into details of technical incompetency or of gross dishonesty on the part of employees, there remain to be considered matters of administrative economy, one of the most important of which is the mine store. As mines are usually at a distance from distributing centres for merchandise, it is generally necessary to establish at the mine a store to supply the employees with provisions, clothing, and other necessaries. Without having accurate figures from different camps for comparison it may be said that in Mexico from 50 to 80% of the miner's wages is paid through the store, and in the United States from 25 to 40%. Bearing in mind the large profits taken by many company stores, ranging from 40 to 50% in the United States to 60 or 80% in Mexico, it may safely be stated that a mine-store frequently receives as profit from 20 to 40% of the monthly pay-roll, and occasionally as much as 50 to 60%. In the case of a company organized for the benefit of its stockholders, the mine-store should be a part of the mining enterprise, and its profits should be a rebate against the cost of operation, but everyone who has lived or traveled in mining countries knows that, in many instances, the store is a private perquisite of some favored officer, or officers, of the company, and that often, through years of development or other unproductive work, the mining business shows no profit, while the store returns every month to its owners a substantial percentage of the pay-roll. In a large camp the business of supplying meat is sometimes kept separate from the store, and this also may be a perquisite of some favored official. Every mining engineer of experience knows these things, but in many cases, in the position of superintendent, he has no voice in their disposition. He is simply paid to look after the technical end. Yet the technical end cannot wholly protect the investor.

The question therefore is, can the Mining & Metallurgical Society of America achieve protection for the investor? If not, let us be frank and admit our limitations, and if the blame for lack of protection should and can be placed elsewhere, let it be

placed where it belongs. The writer claims that the investor is generally at a disadvantage through lack of knowledge of the methods used in promotion and stock-selling; also through lack of knowledge of the general principles of mine administration.

As a strictly ethical proposition, no mine administration should be considered as wholly in the interest of the stockholders, where the profits of the mine-store are not an asset of the company. Of course, where the mine is paying dividends, the question is never raised, but with many a company, the mining business never makes a return to the stockholders, while the store pays good profits to its owners.

F. J. H. Merrill.

Nogales, Arizona, January 20.

Electric Counter-Balanced Hoist.

The Editor:

Sir—Referring to C. W. Van Law's contribution in your issue of November 14, I would state that a notable instance of counter-balanced hoist of this kind was that installed in 1895 by Thomas H. Leggett at the Standard mine in Bodie. It was an ordinary 50-hp. Lidgerwood geared hoist, and while it had a capacity of about 400 ft., to equalize the load which was on the same circuit as several other motors, the drum was divided by boring holes through the cast-iron shell and bolting on a ring of wood capped with iron. The counter-balance was arranged as in Mr. Van Law's case, so that the motor was doing equal work when hoisting the counter-balance and hoisting ore. An interesting feature about this was that the travel in the counter-balance compartment was insufficient, the shaft being blocked in some way. Accordingly on the top of the counter-balance a running-sheave was fastened, set diagonally in the compartment, so that as large a sheave as possible could be used and avoid undue bending of the rope. The counter-balance rope passed down the shaft underneath the sheave and up again to an anchorage at the top. This device worked with entire satisfaction for many years, and, so far as I know, is still operating in that shaft.

Some years before this I arranged the installation of a similar over-balanced hoist at the Colusa Parrot mine at Butte. It had a first-motion engine, with Corliss valves. The counter-balance ran on special guides in the pump-compartment. It accomplished the desired end of equalizing the strain in consumption and economizing fuel admirably.

R. Gilman Brown.

London, January 18.

Diamond Manufacture.

The Editor:

Sir—The valuable and interesting article on 'Researches in Diamond Making,' by F. H. Mason, which appeared in your issue of December 5 last, is of special interest to me, and strangely coincides with the mechanical ideas I had in view for accomplishing the same purpose. My plans were to use tubes heated electrically, and to bring the pressure up to 50 to 100 tons per square inch by the superheated fluid and gases within. I thought of employing cannon-steel 5 to 10 in. thick, and nested several times. On their inner walls the tubes were to be lined with a hard carbon lining. They were to be anchored in a strong solid formation and to rest in the centre of a 5 to 10-ft. cube of reinforced concrete, everything being arranged to handle the work from a distance by electrical connections, and thus avoid personal injury. Mr. Threlfall's hydraulic appliance using graphite is simpler. I take issue, however, with Mr. Threlfall's chemical ideas in regard to the formation of the diamond. The attempt to crystallize it out of graphite at temperatures of from 7000 to 8000° C. is not in accordance with our knowledge on this subject at the present time. The decomposition of carborundum by means of iron has also, as Mr. Mason states, not been successful. If we critically examine the diamond-producing problem by making a study of the physical and chemical properties of the stone found in nature we will find that the diamond begins to lose its color and transparency at a comparatively low temperature, and with the air or oxygen excluded it is gradually transformed into its coke and graphite modification on more intense heating. In other words it *cannot stand heat*; the diamond therefore must have been formed, even if under high pressure, at a rather low temperature in its original matrix. Its hardness may also be the result of an inherent quality of crystallization, and if the physical data could be secured it would be shown, that such an enormous energy per unit of weight as Mr. Threlfall applied, is not required in the crystallization and production of the diamond. I think that by a new method this crystalline and transparent variety of carbon may be produced, and that those properties will be included that give to this highly-prized jewel its scintillating quality and great beauty. I would be pleased to join forces with Mr. Threlfall to carry the matter out.

D. Mosher.

San Francisco, December 12.

Reducer in Fire-Assaying.

The Editor:

Sir—In your issue of October 3 appeared an article, 'A New Reducer in Fire-Assaying,' by E. A. Rose. In view of the fact that your journal and others have considered it worthy of reproduction, I think that statements therein should not be allowed to pass without comment. It is scarcely correct to call iron sulphide a new reducing-agent, when we have $Fe_n S_{n+1}$ and FeS_2 occurring naturally in ores to be assayed. Also the reducing action of FeS has previously been determined. (See 'The Reduction of Lead from Litharge', *Trans.*, A. I. M. E., Vol. XXXIV, p. 395.) That the proposal to use iron sulphide in place of a carbonaceous reducing agent is new, is not questioned, for the presence of sulphur in an assay is more objectionable than desirable.

The article fails to observe the facts that considerably more gas is evolved from decomposition of the alkaline carbonates than from the oxidation of carbonaceous reducing agents, and that sulphur may be

oxidized to SO_2 or SO_3. In the oxidation to SO_2, which escapes as a gas, no reduction in boiling takes place, while to oxidize sulphur to SO_3 requires a basic charge high in litharge, which gives a non-viscous slag, that has as much to do with the decreased boiling and time of fusion as the use of a reducing agent producing no gas. The charge given, using pure silica for ore, and substituting argol for FeS, was fused in a 15-gram crucible without boiling over, which according to the statement made should have given trouble in a 20-gram crucible. The effect of this character of charge on boiling in assaying sulphide ores was noted in the above-mentioned article, in the *Trans.*, A. I. M. E., p. 397. How 15 to 20 minutes is to be saved in the time of fusion is a question, as 25 minutes is ample for ordinary acid ore-charges, and to make a fusion at any reasonable assay temperature in 5 to 10 minutes is preposterous. In what way this reducing agent is to appeal to those who have sulphide ores to assay by the nitre method, where no reducing agent is required, is an enigma.

To sum up: in order to make use of a new reducing agent, which in itself slightly decreases the boiling and time of fusion, Mr. Rose has found it necessary, on account of the properties of this reducing agent, to devise a charge excessive in flux, particularly PbO, which is expensive; and furthermore, causes rapid destruction of crucibles. This high PbO-charge will also give questionable silver results. The advantages are so far outweighed by the disadvantages that they cannot be considered.

E. J. Hall.

New York, January 15.

Note on Drilling.

The Editor:

Sir—Regarding the information asked for by 'Halifax' in your issue of December 5, I would state that for the kind of work that he outlines, and for the depth he mentions (60 ft.), the Chapman boring outfit would be as good as he could get, providing that he has no very hard rock. This system is excellent for holes such as he mentions, and in suitable ground is very fast. If he has hard rock, the diamond-drill is, in my opinion, the best. The diamond-drill can be operated by hand-power for such shallow holes as 60 ft. I regret that I have no data at hand to supply him with, but I am "out of civilization" at the present time. If, as his letter intimates, he wishes to eliminate 'springing' by drilling 3-in. holes, I venture to think that he will regret adopting such a policy, especially if he is engaged in quarrying 'dimension stone,' because by careful springing, he can get a better 'break,' with less shattering of the rock, and with less powder than if he depended on the hole or holes to break the ground. Even if he does not want 'dimension stone,' better results can be obtained by judicious springing, than without. In regard to the charge to be used, it is impossible to state any definite amount on such indefinite data as he gives as to the nature of the rock and the work to be accomplished by the charge or blast. If 'Halifax' can give some idea of the nature of his rock, and the position it is in (whether it has a face or not) and the purpose it is to be used for (whether dimension stone or not) it would be easier to advise him intelligently. I may add that I have never been connected in any way with any drill-manufacturing firm.

C. R. Gent.

Trimmer, California, January 5.

Progress in Cyanidation.

The Editor:

Sir—It is an accepted principle in our profession that a mining engineer is entitled to have his report published in full or, alternatively, that any extracts from his report be submitted for his personal approval prior to publication. In your case you do me the honor to publish my review of progress in cyanidation at greater length than the manuscript sent you for publication authorizes. Doubtless your reason for this is your knowledge of my views on certain vacuum and pressure filters and the impossibility of communicating with me prior to your going to press. I must therefore take this opportunity of stating that the eulogistic views attributed to me in your issue of January 2, relating to some of the vacuum and pressure filters do not represent my whole views, and, on the other hand, had I decided to publish any statement regarding the Burt filter I should have wished to offset my remarks as to the possible difficulty of effective washing by this filter, by a reference to the remarkably low costs of its operation, shown by the figures published of the work at El Oro.

By a misprint on page 49, the figure 27 is substituted for the correct figure of 25, representing the daily output tonnage resulting from the filtering of pulp of 66% moisture; and on page 50, the 17¼cv. should be 17¼ pence, the figure of the cost of crushing by Chilean mills at Pachuca.

Alfred James.

London, January 25.

[This correction illustrates the need for care in designating money units when speaking of Mexican business; unless otherwise specified it is fair to assume that figures are in terms of Mexican currency, but it is well always to leave no room for doubt.—Editor.]

A novel fire-detecting device consists of a fine copper wire core, encased in fusible metal, which, in turn, is covered with insulating material, the whole being contained in a copper tube, about one-tenth inch diameter. This wire is strung the same as ordinary bell wire, or used in short sections attached to terminals and mounted on porcelain blocks in the form of a thermostat. When the temperature rises to the point at which the wire is designed to operate, between 160 and 370° F., the fusible alloy softens and expands through the meshes of the insulation against the inner surface of the copper tube, thus forming a positive and permanent contact between the latter and the core wire, and causing the alarm bells to continue ringing until either the battery is exhausted or the circuit is intentionally broken.

SINKING A WET SHAFT AT TOMBSTONE.

Written for the MINING AND SCIENTIFIC PRESS
By ELTON W. WALKER.

In sinking the main pumping shaft of the Tombstone Consolidated Mines Co., there was struck what is probably one of the largest continual flows of water ever dealt with in the history of shaft-sinking. Pumping from this shaft was started in January 1902, and has been practically continuous ever since. From the beginning 2550 gal. per min. has been pumped. During the past year the average pumped has been approximately 3400 gal. per min. Water was first entered at a depth of 570 ft. below the collar of the shaft, and the mines of the company have now been drained to a depth of 837 ft., so that development is now in progress at a depth of 1000 feet.

While the amount given above represents the total water pumped from the shaft, a portion of it entered at the levels, but it is safe to say that the shaft has been sunk against a continuous flow of from 2200 to 2400 gal. per min. At times this amount has been exceeded, rendering it necessary to provide one or two extra sinking-pumps in addition to the regular equipment, which consists of four.

The shaft measures 8 ft. 10 in. by 23 ft. 8 in. outside of timbers—10 by 10 in. Oregon pine—and consists of four compartments. Two compartments, 5 ft. 9 in. by 7 ft., were used for the sinking-pumps, piping, etc., and the remaining two compartments, 4 by 7 ft., were used for hoisting purposes. In the end pump-compartment a small cage 24 in. wide was used for the convenience of the pump-men in handling the sinking-pumps, pipes, etc. This narrow width of cage was necessary in order that it might pass between the discharge-pipes of the sinking-pumps, and be lowered close to them. The remaining pump-compartment, in addition to carrying two such pumps at the bottom of the shaft, contained the main discharge-columns from the station-pumps as well as the steam and air-pipes. The inner hoisting-compartment was used in sinking the shaft and the remaining compartment for hoisting from the working levels above. Sinking was done with a cage and car, running on removable guides extending below the timbers. In Fig. 1 is shown the plan and elevation of the bottom of the shaft, together with sinking-pumps, bulkhead, and accessories.

The pumps used while sinking were of the duplex type, 14 by 8 by 12 in., having 8-in. suction and 6-in. discharge, and were made by the Fred. M. Prescott Steam Pump Co. These pumps have a rated capacity of 600 gal. per minute under a 250-ft. head, and gave excellent satisfaction at all times, suffering little or no damage from blasting; in fact, a couple of these pumps remained in continual operation at the bottom of the shaft for several years without being brought to the surface for overhauling. As there was always the possibility of their being drowned—as occurred in a couple of instances—all nuts that might become loose, and so put the pumps out of commission, were provided with cotter pins in order that the pumps might be kept in operation even if submerged. In one instance, after the pumps had been drowned and were covered with 90 ft. of water, when steam was admitted they started up after a short interval of warming.

The pumps were handled with 5-ton duplex chain-blocks, hung on steel rails, which rested on the timber sets above the pumps. When the pumps are in position the chain-blocks are tightened and support most of the weight of the pumps. The pumps are held to the side of the compartment by small jack-screws placed between the water-chest and the opposite side of the compartment. The jacks were fastened to the pumps by a piece of rope so that there would be no danger of dropping the jack into the sump if it should become loosened. Thus there was little or no vibration in the pumps, and they could be easily freed for lowering. To the back of each pump is bolted two hangers of 3½ by 1¼ in. iron, having at the upper end an arm, which is hung on the timbers of the shaft. These hangers support part of the weight of the pump, but are used more for a temporary support while moving the chain-blocks.

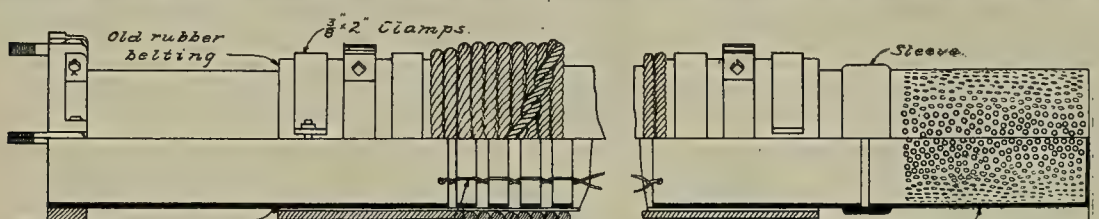


Fig. 2.

Each pump is provided with separate steam, exhaust, and discharge-pipes extending to the pump-station above. In order to facilitate lowering of pumps and connection of pipes, each pipe is provided with a long slip-joint. These slip-joints are always left connected to the pump, and provide for any variations in the length of the sections of pipe used when lowering the pumps. The steam-pipe is provided with a valve at each pump as well as one at the station above. In this way if the pump become submerged it is possible to regulate it from above if the lower valve is left open.

The shaft-sets are 5 ft. from centre to centre and the pumps are lowered one set at a time. The method used in lowering is as follows: The pipe-connections are first loosened to allow the pump to swing free of the timbers, when it is lowered 5 ft. with the chain-

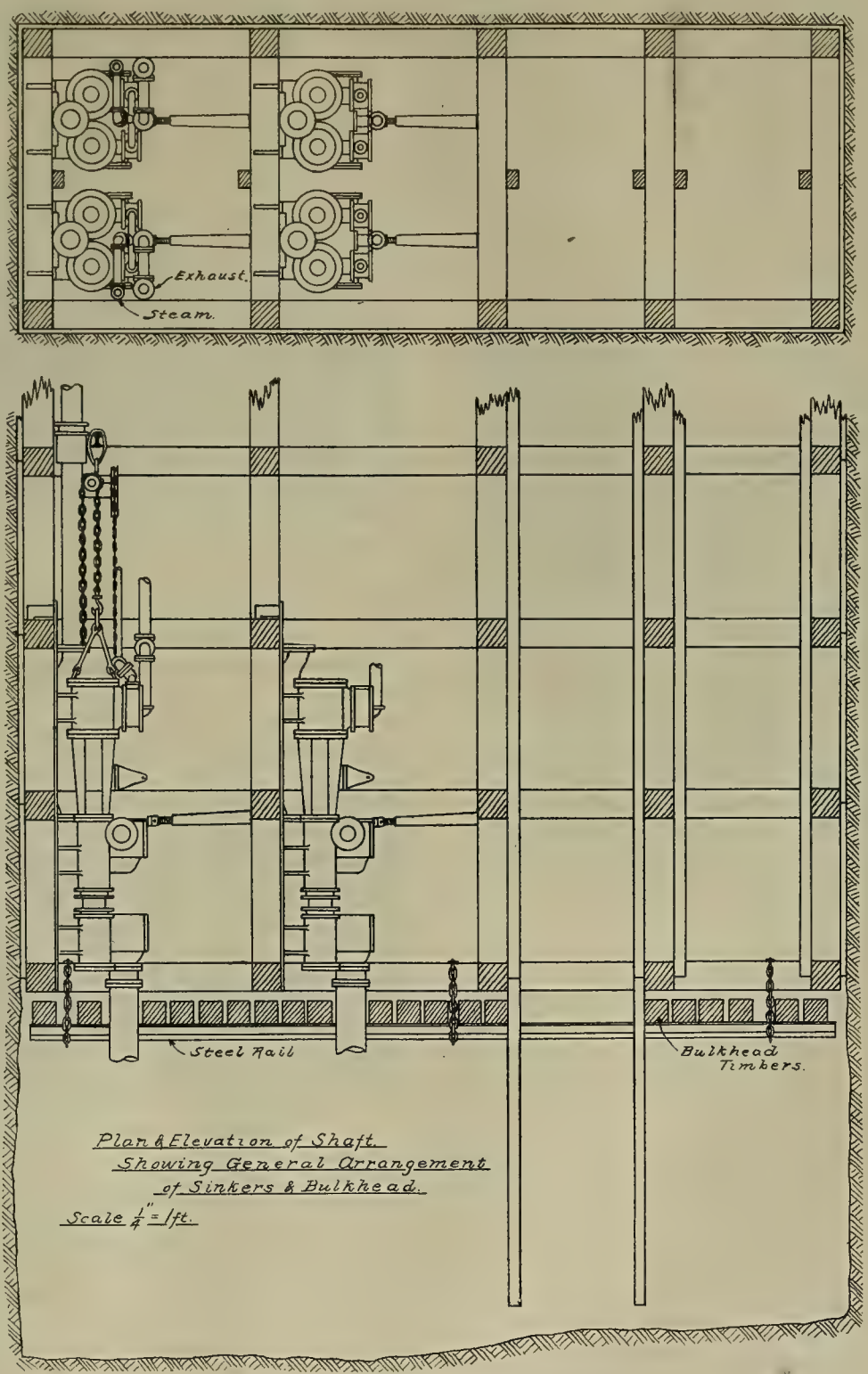


Fig. 1. Shaft-Sinking in Wet Ground at Tombstone.

blocks and hung on the timbers. The expansion-joints, which have a movement of 5 ft., are then pulled out and the pipes connected. At the second lowering the pumps are dropped the same distance, and the expansion-joints are closed together, allowing a 10-ft. section of pipe to be put in place. The third lowering is done with the expansion-joints as at first. At the fourth lowering the 10-ft. section of pipe is removed and a permanent 20-ft. length put in place. This operation is repeated as the pumps are lowered. Ordinarily three or four hours are consumed in lowering, but in an emergency it can be done in considerably less time. In fact, three pumps have been lowered in five hours.

In the earlier part of the sinking, ordinary 8-in. plain-bore rubber suction-hose wound with two layers of a cheap grade of ¾-in manila rope, to protect the hose from flying rock when blasting, was used; but later a home-made suction-hose (Fig. 2) was devised, which cost about one-third the rubber hose and proved more satisfactory. In making the hose, 8-in. pipe was cut into rings about 1¼ in. wide, and these rings were wired together, leaving a space of about ½ or ¾ in. between the rings. The whole was then covered with three layers of heavy canvas sewed on, each layer being made air and water-proof with pine tar. The hose was then covered with rope, as was done with the rubber hose. The total cost of making an 18-ft. length of hose was $25.50. This cost includes all labor and material except the rings, which were cut from scrap pieces of pipe. The rope and the winding of it are also omitted, as this cost would be the same if a rubber hose were used.

In order to protect the sinking-pumps and shaft-timbers when blasting, as well as to protect the men working below, a bulkhead was used below the shaft-timbers, as shown in Fig. 1. Two steel rails the length of the shaft were hung below the wall-plates by chains and on these 8 by 8-in. timbers were placed close together, leaving an opening through which the hoisting-cage could pass.

On account of the great volume of water it was not possible to remove the suction-hose when blasting, only the lower end being raised from the bottom with chain-blocks. The pumps were stopped when blasting, so that when the holes were shot there was from three to five feet of water covering the holes; this water acted as a cushion and helped to protect the timbers and pumps.

Detailed figures are not available as to the cost of sinking the upper part of the shaft, but the cost of sinking from 879 ft. to 1017 ft. was as follows:

Powder	$468.24
Caps	25.08
Fuse	141.96
Lumber, lagging, etc.	1,772.85
Supplies, oils, grease, slickers, boots, etc.	1,357.97
Compressor and drills	660.25
Labor (miners)	8,089.95
Labor (miscellaneous)	231.80
Total	$12,749.10
Feet sunk	138
Cost per foot	$ 92.38

Owing to operating conditions, it was impossible to arrive at the cost of hoisting from the shaft with any accuracy, and for this reason the cost of hoisting is not included in the above.

Effects of forest denudation in China are thus described in the recent message to Congress by President Roosevelt: The floods and freshets which diversify the general dryness, wash away from the mountain sides, and either wash away or cover in the valleys the rich fertile soil which took tens of thousands of years for nature to form; and it is lost forever, and until the forests grow again it cannot be replaced. The sand and stones from the mountain sides are washed loose and come rolling down to cover the arable land, and, in consequence, throughout this part of China, many formerly rich districts are now sandy wastes, useless for human cultivation and even for pasture. The cities have been, of course, seriously affected, for the streams have gradually ceased to be navigable. There is testimony that even within the memory of men now living there has been a serious diminution of the rainfall of northeastern China. The level of the Sungari river in northern Manchuria has been sensibly lowered during the last 50 years, at least partly as the result of the indiscriminate cutting of the forests forming its watershed. Almost all the rivers of northern China have become uncontrollable, and very dangerous to the dwellers along their banks as a direct result of the destruction of the forests. The journey from Peking to Jeho shows in melancholy fashion how the soil has been washed away from the whole valleys, so that they have been converted into deserts.

Coal in the Philippines is found on the islands of Cebú, Batán, and Polillo. The Lantauán field on Cebú, is characterized by thick veins of bituminous coal exceedingly low in ash and sulphur, but also low in fixed carbon, the moisture being as high as 17%. Similar comment will apply to the coal of Batán, except that the seams are thinner and more dislocated by faulting. The volatile hydrocarbons in this coal average about 42%, showing it to have superior value as for gas production. In fact this characteristic applies to all the Philippine coals, the Polillo coal, for example, having the composition:

	%
Moisture	5.58
Volatile hydrocarbons	41.20
Fixed carbon	49.15
Ash	4.07
Sulphur	0.29

Cocos island, a possession of Costa Rica, lying about 400 miles off the coast in the Pacific Ocean, has been the scene of many fruitless efforts to find buried treasure. It is probably the most noted treasure island in the world. The basis for this reputation lies in valuables from royalist families in Peru, secreted there in the first decade of the nineteenth century. Another story affirms that a second treasure was buried on Cocos island by the crew of the barkentine *Mary Dyer* in 1835. Within the year just past one English expedition searched the island, and now another is being organized in New York under Davenant Rodger and L. H. Andrew.

SUCHEZ DE BOLIVIA HYDRAULIC MINE.

Written for the MINING AND SCIENTIFIC PRESS
By W. E. GORDON FIREBRACE.

In the Canton of Pelechuco, Department of La Paz, Bolivia, is situated the largest auriferous gravel bank known in South America. It is called Suchez de Bolivia in contradistinction to another similar but smaller gravel deposit known as Suchez del Peru.

Suchez de Bolivia is as well known to South Americans as San Antonio de Poto, and like the



Clavijo Ditch From Reservoir to Pressure-Box.

latter it has yielded immense quantities of gold in the past. Tradition has it that these gravel banks supplied a great part of the gold of the Incas. It is on record that from the date of the conquest of Peru by the Spaniards down to the year 1761 large numbers of gold washers were employed, under Spanish direction, on the Suchez bank, and from the



House Built by Clavijo in 1826.

enormous quantities of old tailing to be seen it is evident that many thousands of people must have been engaged in the work. The rising of the Indians against their Spanish masters occurred in 1761, when the entire white population was massacred, and all records pertaining to the working of Suchez were lost. It was not until the year 1826 that Suchez received further attention from the gold-seeker. In this year three brothers, by the name of Clavijo, commenced work on the bank. They constructed a reservoir, which to this day bears their name, made canals and built houses, and during the 20 years they were operating, extracted large quantities of gold. After this the property seems to have been neglected for some years, and was acquired by the present owners in 1890. An installation, consisting of a hydraulic giant and a few hundred feet of piping, was rigged, and water brought to the bank under a head of 400 ft. The results obtained were highly satisfactory, but a difference of opinion between the proprietors caused the cessation of operations.

The formation of the Suchez bank is partly glacial and partly alluvial. It is what is known as channel gravel, and owes its origin to the filling up of a wide deep valley with the detritus coming from the disintegration of the mountains which were constantly being eroded by glacial and other agencies. The mountains are composed of Silurian slates, and this formation is intersected by innumerable narrow quartz veins, many of which are extremely rich in



Bringing Pay Dirt to Clean-up Boxes.

gold. It is from the disintegration of these narrow veins that the gold content of the Suchez auriferous bank has been derived. The deposit is composed of small boulders of slate, quartz, porphyry, and sandstone, cemented by a sandy clay. It is easily disintegrated by water under pressure, and throughout the whole mass, from the surface to the present working level, free gold is disseminated. There does not appear to be any overburden or barren gravel; it all contains some gold; some places are richer than others, and like other large gravel deposits in this region. Suchez has several rich *veneros* or pay-streaks running through it. The gold is exceptionally pure, and sells at $20.50 per ounce. It occurs as dust, flakes, scales, and nuggets; it is not uncommon to unearth nuggets weighing as much as one ounce.

Suchez is situated at an altitude of 15,000 ft. above sea-level, and is just within Bolivian territory, the boundary of the concession being the imaginary line which serves to divide the Republic of Peru from that of Bolivia. One would naturally assume that the difficulties of working would be enormous at such

an altitude, but this is not the case. Although Suchez is mostly above the line of perpetual snow, water never freezes, and there is nothing to prevent sluicing for at least 9 months of the year. At the foot of the Suchez bank is Lake Suchez, into which the tailing has been dumped in the past. This lake is large and deep, and can be utilized as dumping ground for many years to come. The quantity of gravel available for washing appears to be almost unlimited, and several engineers, who have professionally visited the property, are unanimous in stating that 400,000,000 cu. yd. can in no way be considered an exaggerated estimate.

As regards the average value per cubic yard of this enormous mass there is not the same unanimity of opinion, although all agree that there is sufficient gold to pay handsomely. The lowest estimate is 16c. per cubic yard, and the highest 33c. The result from the washing of many thousands of yards of gravel is reputed to have been equal to the higher estimate, but in my opinion it would be more prudent to put the average value per cubic yard at 20c. Working costs should not be higher at Suchez than in California or New Zealand, as labor is much cheaper. The daily wage paid to ordinary native laborers in this district is 20c. Overseers and mechanics receive a few cents more. The native is fairly intelligent and soon masters the work required of him, and can easily be taught to become an expert nozzle-man. The present water-supply is obtained from the melting of the snow, and does not permit of working for more than a few weeks in the year. These waters are collected in the Clavijo reservoir; from there they are conducted by a ditch to the pressure-box which is about 400 ft. above the giant. No attempts in the past have been made to improve the water-service, although it was known that there was in the district a considerable quantity of water, at a sufficiently high altitude, to be brought to the property. This supply of water has now been definitely determined as being 1500 miners inches, and it is confidently anticipated that a further 1500 miners inches will be available. Some of this water will have to be brought a considerable distance, but as there are no depressions to be crossed it can be conducted by ditches, the construction of which will not be a costly undertaking. The best way to reach the property is by way of Mollendo, a port in southern Peru; thence by train by way of Arequipa to Puno; from Puno by steamer across Lake Titicaca to Huaicho; and then by mule to Cojata and Suchez. If the construction of the road, contemplated by the South American Co., which has lately acquired San Antonio de Poto, is carried out, it will be of great advantage to Suchez, as this road will pass close to the property and will permit of the transport of supplies by carts or traction engines. At present all material must be transported on mule-back. At Suchez are a comfortable house, store, workshops, and other buildings, and the property is only 15 miles from Poto, at which place is a telegraph office. An English company has taken an option and engineers are now on the way to examine the property.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

J. W. B., Orland, California: Basic schist.

J. M. K., Nelson, Nevada: Quartz gravel with much hematite.

W. S. M., El Placer, Oaxaca, Mexico: Porphyritic rhyolite or possibly dacite.

T. B. B., Winnemucca, Nevada: No. 1, weathered rhyolite; No. 2, diabase or basalt; No. 3, shale.

P. E. L., Bishop, California: No. 1, mica schist; No. 2, metamorphosed pyroxene rock containing a mixture of the sulphides arsenopyrite, pyrite, chalcopyrite, and pyrrhotite.

D. J. S., Denver: Specimen too small for satisfactory examination; probably an indurated shale but with a greenish color tinged with brown as though limonite and chlorite were present in considerable amount.

Bear's Nest lies next to the Paris claim of the Alaska Treadwell Mining Co., on Douglas island, Alaska. One has proved as big a fiasco as the other a treasury. In 1896 the Bear's Nest was the scene of an impudent scheme of deception, warranting a re-christening of the mine to Mare's Nest. An option was taken and a company formed. An adit had cut the lode, which resembled that of the Treadwell mine in everything except the gold content. Ore from the big open-cut of the Treadwell mine was brought by night to the Bear's Nest and thrown on the dump, so that samples taken next day yielded good assays. Later, four diamond-drill holes were sunk from the adit, and these are said to have been 'salted' with gold chloride. The first trick fooled the experts representing English capitalists, and the second deceived some German investors and their advisors. Another version states that holes were dug in the outcrop and filled with ore from the Alaska Treadwell mine. When milling was started, it was found that a trick had been played, thereupon a diamond-drill hole was put down alongside the bore previously made and it proved barren. The original hole was reamed out and the ore found to assay nothing, although the core had assayed well. Nothing has been done since then, although the amount of sane prospecting done at this end of the lode is insufficient to prove non-persistence.

New Chinese weights and measures just put into effect are defined in terms of the metric system. The new unit of length is the 'tchi,' equivalent to 32 centimetres; the unit of capacity is the 'to,' equivalent to 10.355 litres; the unit of weight, the 'lian', equivalent to 37.301 grams. About a year ago the Chinese board of revenue and commerce was authorized to devise and put into effect a new system of weights and measures throughout the Chinese Empire.—*Mining World.*

CORNISH PUMPS AND PUMPING ENGINES.—I.

Written for the MINING AND SCIENTIFIC PRESS
By HENRY F. COLLINS.

The following remarks, based upon practical experience in the working of large Cornish pumps in Cornwall, Wales, Spain, and elsewhere, were suggested by a recent discussion in the MINING AND SCIENTIFIC PRESS, in particular by a letter published in the issue dated October 24, 1908, from my friend E. R. Woakes, whose statements I can corroborate from personal observation. At the outset I think it is advisable to draw a clear distinction between the usual Cornish system of pumping, that is, Cornish pitwork, and the Cornish pumping-engine, which is the single-acting engine briefly described in Mr. Woakes' letter. Cornish pitwork may be operated by a Cornish engine, but it may also be operated by an inverted single-acting beam-engine, simple or compounded, by a double-acting beam-engine and flywheel, or by a compound horizontal engine, the reciprocating motion in this last case being transferred from a horizontal to a vertical direction by means of 'angle-bobs' or quadrants. There is, however, an important difference in the pitwork itself when a horizontal engine is employed, namely, that whereas in the original Cornish system and in all the variants that employ vertical cylinders and a walking-beam, only one main rod with its set of plungers is used for each engine; when a horizontal engine is employed it becomes convenient and economical, if not absolutely necessary, to employ two main rods and sets of plungers for one engine. This plan offers both advantages and disadvantages: on the one hand the pumping capacity of the plant is doubled for a given size of engine, since useful work is done upon both strokes; this naturally makes for economy in capital outlay, as does also the fact that the engine-house is of a less expensive form and less expensive construction than is required for engines of the vertical type with walking-beams. On the other hand the 'angle-bobs' or quadrants with their foundations have to be made so massive as practically to offset any saving on engine-house and foundations, and go some way toward compensating for the heavy cost of the extra engine required to work the second rod. Again, however, the further fact must be considered that with a horizontal engine and quadrants it is easy to arrange the two rods side by side in a pumping compartment of reasonable dimensions, whereas in cases where the quantity of water to be raised is more than can be conveniently handled by a single main-rod with its set of plungers the two vertical engines (on opposite sides of the shaft) required in the single-rod system would close it in very awkwardly and render pitwork changes exceedingly difficult unless the shaft were reserved for pumping only. In practice, the maximum amount of water that can be continuously raised by one rod and set of pitwork from a great depth may be put at about 1200 imperial gallons per minute or say 1,700,000 gallons (8500 short tons) per 24 hours, which is what can be done with 24 in. work, anything over this size being unhandy for rapid changes, particularly as regards sinking lifts, for which 19 or 20-in. buckets, valves, etc. prove to be convenient.

Let us then consider the term 'Cornish pumping' to mean pumping by means of plungers in series attached to a reciprocating main rod, each plunger drawing from the cistern into which the water is discharged from the lift below and delivering to the next above in the same manner. The special advantages of Cornish pumping may be summarized as follows:

1. Reliability: Having a well erected system of Cornish pitwork kept in thorough order, a harassed superintendent can sleep at night, sure that no trouble with the pumping is likely to mar his rest. Given proper erection in the first instance and careful supervision afterward, sudden stoppages of the whole pumping plant, due to failures of main-rods or of connecting rods to balance bobs, etc., will not happen more than about once a year. Changes of leaky valves and buckets, worn brasses, etc., can be foreseen and indeed form part of the regular routine; the aggregate amount of stoppage entailed by such changes is barely a tithe of that necessary with direct-acting underground steam-pumps. No one who has had practical experience both of the troubles inseparable from direct-acting steam-pumps underground and of the smooth working of large Cornish pitwork could ever contemplate giving the preference to the former for other than temporary or emergency purposes, the only advantage of the direct-acting pump being its low first cost.

2. Flexibility: Seeing that large Cornish pitwork when operated by an engine provided with cataract gear can be easily regulated to run at 1½ or even 1 double stroke per minute, and that if in good condition it can safely run for long periods at 7 or even 8 strokes, it is evident that a wide range of capacity is readily obtainable—and with practically no loss of efficiency save the increased proportion of the total heat lost by radiation at the lower speeds, and the increased leakage through the valves. This is an important advantage as compared, for instance, with electrical pumps, the efficiency range of which is so limited that such a degree of flexibility as that mentioned can only be obtained by multiplication of small units.

3. Durability: No other type of pumps or of pumping-engine has anything like the life of the Cornish pumps and engine. At the present moment in Cornwall and Wales numbers of Cornish engines with 60 to 80-in. cylinders are being operated although from 40 to 50 years old, while one engine can be cited at East Pool mine that was built in the year 1834 and has therefore been working more than 75 years, the only material renovation in all that time being the replacement of the 60 in. cylinder with its valves, nozzles, etc., by a new 70 in. cylinder about 20 years ago. This is sufficient testimony to the durability of the Cornish engine. As to the pitwork, it often becomes rusted and corroded by acid mine-waters, but otherwise wear and tear is at a minimum, the slow motion, of course, being a great advantage from the point of view of durability. The iron-work of valves and buckets apart from hoops

and gearing never wears out and where the water itself has no corrosive action the metallic seatings of the valves require re-facing only at long intervals, while the plungers themselves when properly packed will work for many years under favorable conditions, with scarcely any appreciable wear.

4. Adaptability to sinking against water: This fact, mentioned in the recent correspondence in this journal, is in reality the crowning glory of the Cornish system of pitwork. Even when the quantity of water issuing from the bottom of the shaft is only moderate, say 300 gal. per min. and upward, it is both cheaper and more convenient to sink by means of a bucket-lift attached to the main rod rather than by means of a direct-acting sinking-pump, for which not only has a rising main to be run up to the cistern of the station-pump, but a separate steam-pipe has to be brought down and usually a separate exhaust-pipe has to be carried up. When, however, the quantity of water in the bottom of the shaft increases to 600 or 700 gal. per min. there can be no question of the greater economy and convenience of the Cornish system. Not long ago I had to sink a large shaft, which was already down 820 ft., to a farther depth of 400 ft. without interfering with its use as the main working shaft of the mine. The in-coming water of the mine varied between 350 and 500 gal. per min., according to the season, but the country rock was so jointed that the moment sinking began the whole of the water dropped to the bottom of the shaft while more came in, and sinking thereafter had to be continued against the increased quantity of 600 to 700 gal. per min. This water was handled without any special difficulty by means of a succession of 18½ in. bucket-lifts hanging from jack-screws and worked by bucket-rods attached to the main-rod in the ordinary way, these being sometimes of 8 in. pitch pine and sometimes of 3¾ in. round iron. About half way down, namely at 950 ft. from surface, a new 18¼ in. plunger was put in and the sinking again continued with bucket-lifts in series, a third plunger being put in at 1150 ft. The shaft was 22 ft. by 7 ft. 6 in. inside timbers, the rock a very hard diorite somewhat jointed, and the total cost of sinking over the whole distance averaged only $75.91 per ft., including $22.84 per ft. for the timber—9 in. sets and 1¾ in. lagging, all of pitch pine. The above figure includes the whole cost of fixing and lengthening bucket-lifts, etc., but not the actual cost of pumping the water, this being considered as part of the ordinary mining costs. The operations of sinking and timbering were carried on together and were interrupted several times for various reasons; they took in all about 16 months, the average rate of sinking being thus about 25 ft. per month. Considering the hardness of the ground and the quantity of water to be contended with, and taking into account the further fact that the use of the shaft as the main working shaft of the mine could not be interfered with, this may be considered satisfactory both as regards rate of progress and cost. There is no doubt in my mind that given the heavy water and other conditions, with direct-acting steam-pumps the shaft could not have been got down so rapidly or at anything aproaching the same cost; in fact, without the Cornish pumps the job would have been more difficult as well as much more costly. In this sinking the actual 'clacks' of both buckets and valves were of the ordinary butterfly type faced with leather, but the gearing of the bucket-forms in the working barrels was of a special guttapercha composition that far outlasts leather, particularly where much grit is present. In the plunger-lifts large double-beat valves were employed, the actual 'beats' being rings of the special guttapercha composition above referred to, let into grooves cut in the valve-faces. These rings, when pumping moderately clear water, were found to last on an average 8 to 9 months before they commenced to leak perceptibly, and their replacement was only a matter of two or three hours work.

In its efforts to reduce the number of fatalities in coal mines, the United States Geological Survey, through its Technologic Branch, is about to establish rescue stations in the principal coalfields of the country, in addition to the experiment station at Pittsburg. The new stations will be at or near the greatest centres of accidents, and it will be the purpose of the experts to teach the miners and mine bosses how to use the most approved apparatus for mine rescue work. Government engineers, thoroughly trained in the use of rescue apparatus, will be assigned to these stations, and they will be ready at a moment's notice to go to the scene of any disaster in their district. The experts will be equipped with oxygen helmets, which will enable them to enter a mine at once, even though it be filled with gas or smoke. These stations will also be headquarters for the study of the waste of coal in mining, one of the important problems before the Geological Survey. The coal mining companies are to be invited to send picked men to these stations, where they will be trained in the use of oxygen helmets. It is not the purpose of the Government to engage in general rescue work, but to demonstrate this apparatus until such a time as the mine owners have thoroughly trained rescue crews at their mines. All of the rescue stations are to be in co-operation with the mine owners and State Geological Surveys. One station will be at Urbana, Illinois, in connection with the University of that State. A second will be at Raton, New Mexico. Another station is suggested for Salt Lake City, Utah.

On the southeast coast of Alaska, erosion by the movement of snow has sculptured the mountain masses into pyramidal forms with three to five faces. In these the snow has hollowed cirques that now serve as the gathering places for the névé feeding the glaciers. Between the cirques the rock has been worn to knife-edges or arrêtes, while the central pyramid survives as the hard core of a big mass. This can be expressed also thus: The accumulating snow flowing as a glacier wears a hollow in the mountain side, ending in the formation of cirques between which the corroded rock survives as a comb or arrête.

ORE-WASHING AT CRIPPLE CREEK.

Written for the MINING AND SCIENTIFIC PRESS
By S. A. WORCESTER.

The larger portion of the rock hoisted from the mines of the Cripple Creek district is separated into four products: waste, ore, screenings, and slime. In a few cases a fifth product, called middling, is separated. One or more of the large mines estimate that nearly 85% of their rock is thrown on the dump as waste after sorting, leaving but 15% ore. Hence it happens that a mine shipping 15 tons of ore daily may have to hoist 100 tons of rock, in order to maintain its output. This explains the immense size of some of the larger waste-dumps of this district, which includes, with their immediate surroundings, the towns of Cripple Creek, Victor, Elkton, Anaconda, Goldfield, Independence, Altman, Cameron, and Gillette. In these mines practically the entire vein is broken and sent to the ore-house for sorting, and where the vein is too narrow for a stope or drift, enough waste is shot down to give the necessary width, and all of this rock is sent through the ore-house. In the most economical plants the ore is automatically dumped by the mine-skip through suitable deflecting spouts to any one of several grizzlies. Beneath the grizzley, which is inclined at an angle of 45°, and has bars spaced from 1½ to 4 in. apart, is placed the screen, of ¼ in. wire-cloth with ¾ to 1 inch openings. Middling, or the product which passes the grizzley, but not the screen, is usually allowed to fall with the crude ore from the grizzley into the crude-ore bin, in which case the grizzley is used only to protect the screen from damage by large rocks, and the screen-bars are widely spaced. In some cases a diagonal spout or trough is placed beneath the screen, running from one corner to the opposite one. The spout is very narrow and diverts a small proportion of the screenings into a bin or box. This sample is assayed, and in some cases shows such low value that the screenings are thrown on the dump, as otherwise they would be shipped at a loss to the operator.

It is characteristic of nearly all of the ores of this district that the gold is found principally in streaks of friable material lying between the harder and the barren gangue. In the operations of mining the greater part of the gold-bearing material is broken comparatively small, leaving the waste in coarser pieces. By passing the material over a screen of suitable size of opening, the richer may be separated from the leaner ore. Considerable profits have been made by lessees by merely screening old dumps which had not been previously screened. The fine material which adheres to the gangue, and is removable after screening only by washing, or some equivalent operation, has still higher gold-tenor than the screenings. At the Strong mine, which is an exception to the general rule, in that the ore exceeds the waste in quantity, the sorting, after screening, is done on low tables, using shovels or forks for handling the ore, and picking out the waste by hand. The waste is thrown into cars and trammed to the washer. A primitive method of screening which is used by some of the small dump lessees, consists in shoveling the rock onto an inclined screen in the same manner in which sand is ordinarily screened for making mortar. The second step in the process of preparing ore for shipment is by washing at some mines, and by dry-sorting at others. Where specially accurate sorting is desired, the preference seems to be for washing, for the reason that the various minerals show much more distinctly when the rock is wet, and has the dust removed from its surface. At mines which wash only the waste, the sorting tables are placed at the gate or mouth of the crude-ore bin. The table has a steel or cast-iron top from 3 ft. square to 3 by 4 ft. in size, and from one to four men work at each table. At the larger plants the ore and waste are raked or scraped over the edges of the tables into separate spouts leading to ore and waste-bins, or perhaps to washers. At the Portland, Findley, and Golden Cycle mines, the ore is scraped over the front edge of the table into spouts leading to the ore-bins and the waste is scraped over the sides into spouts leading to the washers. A small piece of sheet-steel is used for a scraper. At the Elkton, Cresson, Granite, and Abe Lincoln mines the crude ore is screened by revolving cylindrical screens, and washed by the Crane patent revolving cylinder washer. This cylinder is inclined, with its lower end below the surface of the water in the slime-tank. The cylinder is perforated with about ½ in. holes, and has an interior spiral which carries the rock from the lower or receiving end to the upper end, and delivers it on a picking or sorting belt. This belt is from 30 to 50 ft. centre to centre, and has a number of spouts beside it, into which the sorters throw the ore, allowing waste to pass on over the end of the conveyor to the waste-bin or car. While the ore is probably washed more thoroughly by the Crane washer than by the more commonly used spraying device, the initial cost of the Crane machine prevents it from being more generally used. Its washing is more thorough, for the reason that it turns the rock over and over, subjecting all sides to the action of the water, while in the spraying-washer the ore merely slides through the machine, without turning over and over, and with very little of the active rubbing which occurs in the cylinder machine. The spraying washer, in its ordinary form, consists of a spout or chute placed usually at the mouth of the crude-ore bin, but in some cases having the ore or waste brought to it by spouts. It has a steel-plate bottom with ⅜ to ½ in. perforations closely spaced and with a slope or fall of two thirds of its horizontal length. A gate at the lower end of the washer is opened periodically by the sorter or trammer, allowing a small quantity of ore to pass through onto the sorting table, or if waste is being washed, the gate delivers it to a car, which is trammed to the waste-dump. The slime and fine material are washed through the perforated bottom-plate into tanks, in which they are deposited. A pump returns the water to the spray-pipes with sufficient pressure to give the issuing jets considerable force, in order to make the washing effective. Usually a rotary pump, driven by an induction motor, is used, but in some cases steam or other pumps are employed. The settlings are

shoveled out of the tanks periodically and dried either by steam-heat or in pans heated by fire. At some plants, as for instance at the El Paso mine, after equipping all crude-ore bins with spraying washers, wash only certain classes of ore, shutting off the water from one or more washers and allowing the ore to pass through dry. The spraying washers used at the Findley and Strong mines have reciprocating perforated pans with a slight inclination. The waste rock is fed to the upper end of the pan from bin-gates, and is sprayed during its passage to the lower end. The slime passes through the perforations into settling-tanks beneath, and the washed rock drops from the lower end of the pan into the waste-bin or car. The simplest form of washer uses an oblong box, having a perforated plate resting a few inches below the surface of the water with which the box is nearly filled. The rock is shoveled onto the plate and moved around in the water with a fork or shovel until washed, the slime passing through the perforations to the bottom of the box, which is cleaned periodically and the slime dried and sold. This crude arrangement is used, of course, only on a small scale. In designing a surface-plant for hoisting ore and preparing it for shipment, it is well, in view of the processes which have been described, to give the ore-house ample height, so that the waste may be delivered at a sufficient elevation to allow of dumping for a considerable time. It is also well to consider the advisability of having the mine-skip dump directly, by suitable spouts, into the ore-house, thus eliminating all expense in transporting from the shaft to the ore-house. Where a large tonnage is handled this item becomes one of considerable importance. The objection which may be raised, that fire in the ore-house would endanger the mine, can be easily overcome, for example, by fire-proof doors. The importance of thorough washing is illustrated by the fact that one large mine has made for some years a constant practice of washing all waste in three successive spraying washers, and saving slime of considerable value by the third washing. A considerable number of old waste-dumps have been washed over with success, in some cases tramming the rock to a stationary washer of the spraying type, and in others using a portable machine having a cylinder revolving in a tank, similar in arrangement to the Crane washer, but small and light enough to be moved and kept within easy shoveling distance of the pile to be washed. The rock is shoveled directly into the receiving end of the cylinder and delivered at the other end to a car, which is trammed away and dumped. Power for rotating the cylinder is furnished by a 2 or 3 hp. induction-motor.

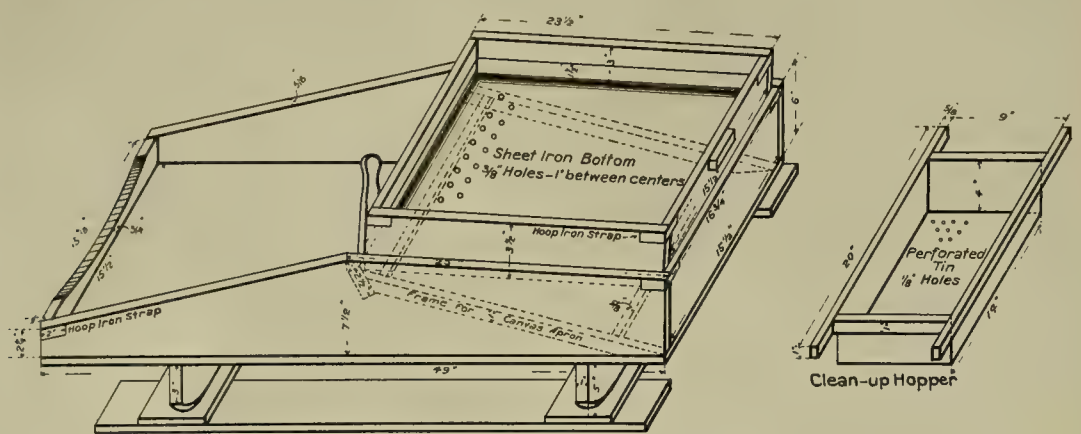
The ore-house and head-frame are of recent design, and embody some of the best features of current practice in small plants. The skip dumps its contents on a short slope, from which they fall on the deflector. This deflector or door may be swung through an angle of 90°, so as to direct the crude ore to either one of the two grizzlies. This arrangement contemplates the addition of a third unit, including grizzley, bins, sorting table, washer, etc., at a future time. As it will be necesasry to handle waste, without sorting, when development is in progress in the mine, a waste-bin is provided, close to the head-frame, and a switch, operated by the engineer, is arranged to dump the skip-load into the waste-bin. The skip is so designed that the box or body can be easily and quickly removed and hung up out of the way. A removable cage-floor is then placed on the cross-bars at the bottom of the skip-frame, converting it into a cage for conveniently handling men, rails, timbers, etc. In this plant middlings are not separated, but pass over the screen and into the crude ore, and are washed and sorted. Ordinary mine cars stand on the sorting-room floor, within easy reach of the sorters, who throw the waste into the cars and tram it to the waste-dump, while ore is scraped over the edge of the table into the vertical spouts leading to the bins below. The screens are adjustable to varying angles, so as to be effective for either dry ores or those which, being wet and sticky, require a steep pitch in order to prevent clogging. The screening-bins have long spouts passing down the corners of the ore-bins and delivering screening at the same elevation as the ore, for shipment. The settling tank for the slime from the washers has several unusual features. Its construction is very cheap, it being merely nailed together, without any tongueing and grooving, the lumber being dressed on one side only and no rods are used. This rough and cheap construction has proved thoroughly practical for slime-tanks of moderate depth. The arrangement of baffles for minimizing the speed of the entering and out-going water and slime and for preventing any rapid currents in the tank, makes it an effective settler and reduces the size and expense of the tank for a given capacity. A steel-plate lining, at one side of the tank, forms a steam heater, through which the exhaust from the hoist passes, preventing freezing in winter, and giving more effective washing than can be accomplished with cold water. An exhaust steam drier, consisting of a shallow wooden steam box, covered by steel-plates, on which the slime is dried, is placed in the space under one screening bin, not occupied by the slime-tank. Light for the sorting tables comes from the top, side, and ends of the sorting room. All bin-bottoms slope 45°, so that no shoveling or scraping is necessary in order to empty the bins. All posts rest on concrete piers, with ¾ inch dowel pins.

The Swelling of Cast-Iron.—Many tests have been carried on to ascertain the percentage of swelling that takes place in cast-iron and these tests have shown the possibility of producing a swelling of as much as 40% in the volume of cast-iron, by heating and cooling. A bar measuring 1 in. square by 14.8 in. long was heated and cooled in a gas furnace 27 times, the high temperature being 1450° F. Careful measurements then showed the bar to be 1⅛ in. square and 16½ in. long. It is thought that this fact explains many of the difficulties experienced with cast-iron fittings for use with superheated steam, where the same sort of alternate heating and cooling takes place.—*Power and The Engineer.*

A ROCKER.

Written for the MINING AND SCIENTIFIC PRESS
By DOUGLAS WATERMAN.

This machine when used in testing placer-ground should be constructed of light material, so that it may be carried easily from place to place, and should be of such design that it will save all the gold. To get the best results the material retained in the rocker should be loose, to allow the gold to settle to the bottom. Insufficient grade will cause the material to pack and the fine gold will wash over the lip. If the rocker be unnecessarily heavy, or if it move through a large arc, the operator is unable to give it the agitating motion required to prevent packing, and loss of gold results. Experience indicates the best design, but it rarely happens that the engineer avails himself of the opportunity to record dimensions for future use. This has led me to present the accompanying drawing of a Chinese rocker of excellent design, in the hope that it may be of assistance to others.



A Typical Rocker.

The Chinese miners in California are expert in the use of the rocker; their methods are as follows: The machine is placed near the shaft or cut, and is carefully adjusted to the proper grade. This is accomplished by blocking the frame or bed on which the rocker rests. It is usual to allow the material to cover a little more than half the bottom of the rocker in the process of washing. The frame is weighted with stones to prevent it moving. A hole is dug under the lip, and another at the head of the rocker; this second hole is made slightly deeper than the first, or, if the contour of the ground will permit, it is at a lower level; and the two are then connected by a shallow trench.

After partly filling the hopper with gravel the operator seats himself beside the rocker, dipping the water from the lower hole with his right hand and rocking with his left. This operation is apparently a simple one, but it requires practice to handle the dipper and at the same time impart an even motion to the rocker. After passing through the rocker, the water falls into the upper hole, returning through the trench to the operator's hand. This effects a great economy where water must be brought from a distance, as the same water is used over and over again. Where accurate results are required it is advisable to re-treat the tailing; thus any gold carried over by muddy water in the first washing is finally recovered.

A clean-up is made at intervals, the frequency depending upon the richness of the ground, and upon the character of the material washed. Ground containing much clay necessitates a frequent clean-up, as the sticky material soon becomes packed in the rocker. The hopper is removed, and the gold on the apron is washed into the rocker. Packed gravel and concentrate on the rocker-bottom is thrown back to the head, and with clean water and rapid agitation the coarser material is washed over the lip. A second hopper with fine holes is then employed to remove all but the gold and fine concentrate. Skilful rocking at this point separates the gold from the black sand, the particles of gold being collected and picked up by a quick motion of the scoop.

Prediction of the recent Italian earthquake was made by Frank Alvord Perret, according to T. A. Jaggar, Jr., writing in the New York *Evening Post.* Mr. Perret, who was decorated with the Crown of Italy for his service to science and to humanity on Vesuvius in 1906, wrote in the *World's Work* of November, 1907: "By the rational methods of scientific research, we know that a great eruption of Mt. Etna is impending, the only uncertainty at present being which side of the mountain will break open." Great volcanic eruptions are preceded by great earthquakes, and the Messina disaster of December 28 comes on an earthquake date ("terrestrial maximum of gravitational stress") actually platted in advance by Mr. Perret on his diagrams for 1908. Like F. Omori, the great Japanese seismologist, he is a man whose whole time is unselfishly devoted to these studies.

Junín is the most important mineral producing department of Peru. The chief products in 1907 were: gold, 44.3 kilograms; silver, 108,026 kg.; copper, 34,302,000 lb.; coal, 169,368 tons; lead, 4970 tons; antimony, 43½; bismuth, 48; and vanadium, 73 tons.

COMPANY REPORTS.

YUKON GOLD.

S. R. Guggenheim, president of the Yukon Gold Co., under date of January 30, 1909, has issued a letter to the stockholders giving a general statement concerning the progress of operations in the Klondike district of the Yukon Territory. He says, in part:

At the time our engineers made their first examination in 1905, the placer fields of the Yukon were fast becoming depleted; the volume of gravel workable at a profit by hand-method was rapidly being reduced, and the cost of working, under the methods then in vogue, precluded the extension of the operations to lower-grade material. The principal factors making toward the high cost were:

First—The disconnected nature of the holdings (the claims being not over 500 ft. in length and owned largely by individuals), which reduced the workings to a number of small-scale operations, and prevented systematic mining upon any larger scale.

Second—The scarcity of water. The miners, both those working upon the creek levels and those upon the bench and hill deposits, were entirely dependent upon the rainfall for their supply of water. As the snow and rainfall is very irregular in the Klondike district, a corresponding irregularity entered into the mining operations, with a consequent increase in cost. No large-scale hydraulic operations were possible with such limited and intermittent water-supply.

Third—The high cost of fuel, labor, and supplies. Wood fuel is available in the Klondike for mining purposes, but its cost is high and constantly increasing. Coal is to be had, but it is as expensive as wood. Labor is high, due to the short season for outside work, and supplies expensive because of high transportation charges, and the small and irregular character of the purchases.

Our investment in the Yukon was based upon three fundamental hypotheses:

First—That we would be able to acquire large and connected blocks of ground for systematic working.

Second—That we would be able to secure and make available at sufficient elevation a continuous water-supply.

Third—That we would proceed to equip the properties with the most modern mechanical appliances, such as dredges and elevators, for handling the gravels upon a large scale and at a low cost, depending for power not upon local fuel, but upon electrical energy generated in our own hydro-electric plant.

All of these things have been accomplished. At the present time our holdings amount to about 90% of the claims located on the hills and creek bottoms of Bonanza, Bear, Hunker, and Eldorado valleys, which were wanted for the enterprise. These properties have been acquired mainly by outright purchase, although in some cases, where unacquired claims adjoin the properties of this company, advantageous working agreements have been made with the owners.

Early in 1906 construction was begun upon a system which will insure to the Klondike a continuous water-supply for all time. This was in itself a tremendous undertaking, involving the diversion of Tombstone river (the main right fork of the Twelve-Mile), carrying it a distance of about 62 miles by flume, ditch, and pipe-line, through a country which was an absolute wilderness when our engineers first went upon the ground.

Simultaneously with the construction of the water system, a hydro-electric power-plant was installed on the Little Twelve-Mile river, capable of delivering 2000 hp., which is transmitted to the placer fields by a high-tension line, 36 miles straight across country, with three sub-stations and 18 miles of secondary line. A huge dam has been built at the head of Bonanza creek to conserve the water of the upper Bonanza watershed for use upon the company's Bonanza and Eldorado creek properties.

Operations in the latter part of 1908 demonstrated the entire success of this method of mining, as applied to the gravels of the Yukon. The difficulties due to frozen ground have been overcome within the limit of a reasonable working cost. Three mechanical elevators were installed, two of which were put into operation during the season of 1908. It is a great pleasure to say that the mechanical elevators, electrically driven, which were designed by our own engineers and used here for the first time in any country, were entirely successful. Since acquiring the properties in the Yukon, we have carried on hydraulicking to a limited extent, and dependent upon the local intermittent water-supply. The operations have shown a profit, and have proved not only the value of the gravel, but also that a very low working cost can be reached.

In the season of 1909 we expect to have the equipment working up to at least one-half of its ultimate capacity. In the season of 1910 we fully expect to show a production which will make the Yukon Gold Co. take rank as one of the largest gold mines in the world. We had only proved our holdings in part, first, because of the advisability of concentrating our engineering staff upon the installation of the present equipment, and second, because of the expense attendant upon the thorough prospecting of ground in the North. Our engineers having reported that we now have nearly $40,000,000 net in proved ground, which is approximately 100% profit on the shares at par, and provides for many years dividends, we concluded to postpone further prospecting of our holdings, until our present plant and equipment are running to full capacity.

The shareholders will be interested to know that a large majority of the outstanding capital stock of the Yukon Gold Co. is owned by the Guggenheim Exploration Co., whose engineers have under their direction the equipment and operation of the properties. The Guggenheim Exploration Co. has financed the scheme from its inception, justifying its investment by the conclusions of its engineers after rigid examination and exhaustive reports. That they are satisfied with their investment is evidenced by the fact that they have not disposed of a share of their holdings. For the past season final results have not as yet been actually determined, but incomplete figures show that the net earnings to December 31, 1908, will be about $550,000.

Our engineers have estimated the probable earnings for 1909 at from $1,100,000 to $1,500,000. The wide difference in these figures is due to the unknown factors entering into the water-supply, and the uncertainties attendant upon the first operation of a new ditch line of such length, and constructed under such difficulties. If we have comparatively few washouts or accidents on the main ditch system or the equipment, our earnings will probably reach the higher figure. In 1910 the net profits of the company should be from $2,000,000 to $2,500,000, and in 1911 and thereafter, $2,500,000 net per annum should be the minimum.

The fact is that the directors of the Guggenheim Exploration Co. feel that they, as pioneers in the industrial development of the North, have taken the first steps toward the establishment of a permanent and substantial mining industry in the Yukon Territory and Alaska. The day of the small operator has come and gone, and in his place entered the corporation, to do the things which few individuals, having the means, would care to undertake; that is, to supply sufficient capital for the development of the resources of the country and make its mining future definitely assured. It required courage to make such an investment, running well up into millions of dollars, but the directors feel that the money and time they have expended in developing the resources of the North, will ultimately result in a large profit to the stockholders of the first company to go into placer mining in this region upon so gigantic a scale. That others will follow in our footsteps we hope and have no doubt, now that we have demonstrated that the frozen gravels can be worked with reasonable operating cost, and in fact that all of the handicaps under which the individual operator labored can be overcome. We feel safe in predicting, therefore, for the future, an immense increase in the gold output of Alaska and the Yukon Territory which naturally will be attended by improvement in local conditions and increasing prosperity.

MINING AND METALLURGICAL PATENTS.

Specially reported for the MINING AND SCIENTIFIC PRESS.

APPARATUS FOR ELEVATING GOLD-BEARING DEPOSITS FROM RIVER-BEDS. No. 910,277. Albert L. Eliel, San Francisco, Cal., and Oscar H. Eliel, La Salle, Illinois.



An open-ended, vertically arranged hollow shaft and a frame in which said hollow shaft is mounted so as to slide and to rotate, in combination with mechanism for moving said hollow shaft vertically, mechanism for imparting to said hollow shaft reciprocating rotary movement, and an air tube connected with the bottom end for introducing compressed air into the hollow shaft when partially submerged.

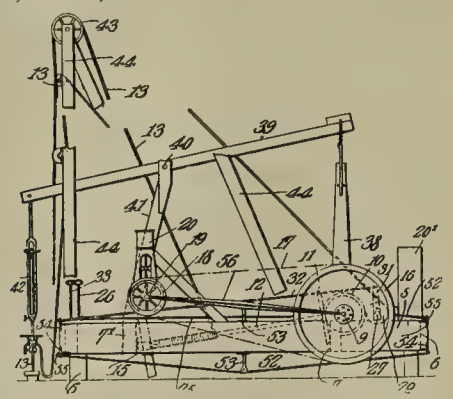
DISTRIBUTING-VALVE FOR PERCUSSIVE ROCK-DRILLING MACHINES.—No. 910,447. Anthony J. Bant and Henry Gullett, Johannesburg, Transvaal.



In an engine, the combination of a cylinder provided with ingress and egress ports, a piston for said cylinder, fluid distributing means located in said cylinder for controlling ingress and egress of pressure fluid through said ports, a device associated with said piston for operating said means, and adjustable mechanism limiting movement of said means and controlling the operation of said device.

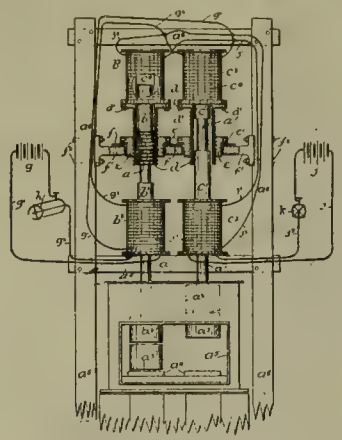
In an engine, the combination of a cylinder provided with ingress and egress ports, a piston for said cylinder, fluid distributing means located in said cylinder for controlling ingress and egress of pressure fluid through said ports, a device associated with said piston for operating said means, and adjustable mechanism for controlling the position of said device.

WELL-DRILLING MACHINE.—No. 910,235. James G. Russell, Stewart, Ohio.

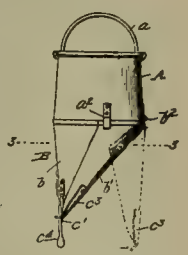


In a drilling machine, the combination with a supporting frame, of a driving shaft journaled in the frame, a drill rope reel extending longitudinally of the frame and having one end thereof inclined downwardly, a derrick arranged near the lower end of the reel and provided with means for guiding the rope to said reel, a crank secured to one end of the driving shaft, a spudding device carried by the crank, a roller journaled in the frame on one side of the rope reel and adapted to guide the rope from the reel to the spudding device, and means for imparting movement from the driving shaft to the rope reel.

ELECTROMAGNETIC STAMP-BATTERY.—No. 910,834. James P. Lynn, Trafalgar, Kalgoorlie, Western Australia.



No. 910,834.



No. 910,253.

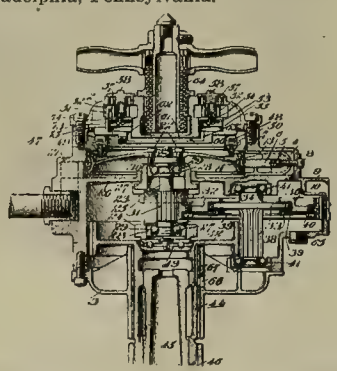
In an electro magnetic stamp battery, stamp stems having enlarged portions, sleeves each carrying a magnet in which said enlarged portions reciprocate, and threaded rotatable devices engaging the sleeves for vertically adjusting the latter to maintain the enlarged portions of the stems within the operative influence of the magnets.

An electro-magnetic battery comprising dies, stamp heads having stems with enlarged portions, sleeves having nuts for vertically adjusting the sleeves, said sleeves carrying upper magnets, the enlarged portions of the stems co-operating with the said upper magnets, and other lower magnets also having portions of the stems in co-operative relation thereto.

DUMP-BUCKET.—No. 910,253. Lewis Wolfley, Prescott, Arizona.

In a dump bucket, a main body portion, a lower portion having a section fixed with respect to the main body portion and sloping toward the centre axis of the bucket, a hinged section also sloping toward said axis and co-operating with said fixed section, and means for latching said hinged section.

TURBO-PNEUMATIC DRILL.—No. 910,428. John W. Smith, Philadelphia, Pennsylvania.

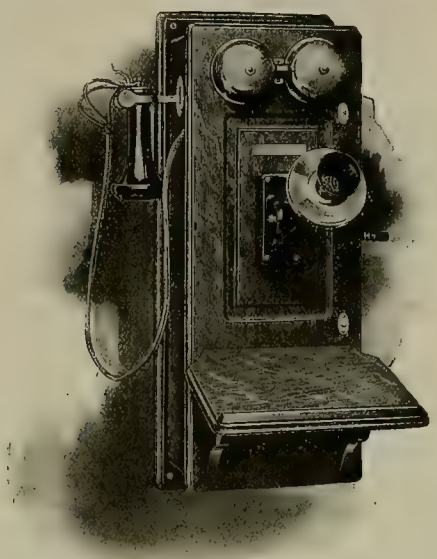


In a pneumatic drill, a casing, a rotor having turbine buckets therein, speed changing mechanism for said rotor, and a detachable stator provided with channels for redirecting motive fluid against said buckets.

In a pneumatic drill, a casing, a rotor having turbine buckets therein, speed changing mechanism having a friction clutch, an automatic brake for said rotor, and means for impinging the motive fluid against the rotor.

Telephones for Mining Plants.

Nothing thus far devised gives the superintendent of a mining plant a greater feeling of security than a knowledge that he has complete control over all parts of his plant through a telephone system. A reliable telephone system saves time and money and facilitates co-operation between the superintendent and his men. It provides means for notifying the men working in the near and distant portions of a plant of a temporary suspension of the power, of a neces-



Magneto Telephone Set.

sary shut-down of some part of the plant, of an accident to the machinery, of immediate repairs to be made, or of other changes. In small as well as in large mining plants, emergencies affecting both life and property often arise which render a telephone system invaluable.

Telephones for mining operations may be divided into



Telephone Set Open.

two classes: those for use in the buildings above ground, and those for use in the mines. Owing to the moisture and gases present under-ground, the telephone apparatus for such situations must be enclosed in iron-clad cases to prevent corrosion and decay. Otherwise, the apparatus does not materially differ from the telephone equipment employed above-ground in the superintendent's office, and in protected parts of the plant. The accompanying illustrations show exterior and interior views of a Western Electric Magneto Telephone set, particularly adapted for mining service. The battery-compartment is large enough to hold three standard dry-cells. A writing shelf, mounted below the transmitter, is convenient in making notes of orders received over the wire. Improved 'Blue Bell' dry-cells are recommended for mining telephone work. Competitve tests show them to have a longer life and higher efficiency than other dry-batteries on the market. A special feature of these magneto telephone sets is the location of the main binding-posts inside the cabinet. This prevents trouble from tampering with the connections and accidentally short-circuiting a set at the main terminals. All the binding-posts are fitted with screw connections. The permanent connections are soldered and the terminals attached to flexible leads are provided for the battery. All apparatus in these sets is made in accordance with the standard of the Western Electric Co. of New York.

Publications Received.

Any of the books noticed in these columns are for sale by or can be procured from the MINING AND SCIENTIFIC PRESS.

COMPARATIVE TESTS OF RUN-OF-MINE AND BRIQUETTED COAL ON LOCOMOTIVES. By W. F. M. Goss. Bulletin No. 363, U. S. Geological Survey.

TESTS OF COAL AND BRIQUETS AS FUEL FOR HOUSE-HEATING BOILERS. By D. T. Randall. Bulletin No. 366 of the U. S. Geological Survey.

THE DESIGN OF HIGHWAY BRIDGES. By Milo S. Ketchum. 8vo., pp. 544., Ill., Index. The Engineering News Pub. Co. New York. 1908. Price $4.

THE GAME FISHES OF BRITISH COLUMBIA. Bulletin No. 25. An admirable series of photographs, with descriptive matter, for those who pursue trout or salmon either for profit or pleasure.

Catalogues Received.

The HARDINGE CONICAL MILL CO., New York, has recently published a small booklet on the evolution of the conical mill. It also discusses the advantages of the Hardinge conical mill.

THE DEMING CO., Salem, Ohio, has lately published an attractive catalogue of its spray pumps. Included is a folding plate on which is given a spraying calendar and formulas for different remedies. Deming spray pumps may also be used to advantage in whitewashing mills, factories, and the like.

The AVERY CO., Peoria, Illinois, is distributing its 1909 catalogue describing its well known line of traction engines, threshers, and steam-plows. A noticeable feature of this pamphlet is the excellent illustrations, prominent among which are the two double-page illustrations in natural color, one of the Avery steam-plow outfit and the other of the thresher.

Commercial Paragraphs.

E. M. WADE, of the firm of Wade & Wade, Los Angeles, has established an assay office at Nogales, Arizona.

THE WELLMAN-SEAVER-MORGAN CO., Cleveland, announces that it will be represented in the West by F. H. Bostwick, who will have an office at 611 Ideal Bdg., Denver.

The BURNITE MACHINERY CO. has succeeded to the business of the Burnite-Leonard Engineering Co., and has established an office and store-room at 17th and Glenarm streets, Denver. Thomas B. Burnite is manager of the new company.

ROBERT W. HUNT & CO. have engaged the services of John Cargill, who will make his headquarters at the firm's New York office, No. 90 West street. He will devote his attention to the examination and report upon railway and other corporate properties.

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EDITORIAL.

FROM the annual report of the Institution of Mining and Metallurgy, London, we note with pleasure that Charles J. Alford, Willet G. Miller, and Frank D. Adams have been elected honorary members.

ACCORDING to latest advices, the Alaska-Yukon Exposition is to be ready early in May, most of the principal buildings being now in a condition to receive exhibits. This fair is expected to attract big crowds to Seattle and it ought to be effective in advertising the resources of the North.

THIS is a severe winter in the North. Cold and stormy weather has prevailed on the southeastern coast, and at Dawson January proved to be the coldest month on record, with an average of 43° below zero. On January 24 the thermometer registered a minimum of 65° below, which is only exceeded by the 68° recorded in January 1901. These figures are given by the official meteorologist.

SOUTH AFRICAN capital in American mining is again indicated by the annual report of the South African Gold Trust, Limited, showing that among this important company's holdings are 48,280 shares of Oroville Dredging and 35,000 shares of Yuba Consolidated; on the other hand, the 27,000 shares of Camp Bird, held in 1905, have evidently been sold.

NEWS from our correspondent in the Tanana region of Alaska indicates that the headwaters of the Kuskokwim river is to be the scene of a stampede this spring. A strike has been made on Tuluksak creek, a tributary entering the Kuskokwim at about 100 miles from its mouth. Work done during the summer of 1908 proved encouraging. Good prospects are also reported about 80 miles up the Anvik river.

THE FEBRUARY bulletin of the American Institute of Mining Engineers has for its frontispiece a portrait of James D. Hague, accompanying a biographical notice written by Dr. Raymond. The portrait is a speaking likeness and will touch many a man in the distant places of the earth with a mingled feeling of pleasure to recognize Hague's kindly face and of sorrow that he has crossed the range. Many old memories will be recalled by Dr. Raymond's biographical note, into which, as usual, he has injected so much of himself as to make the article doubly interesting to his friends.

ON THE retirement of Mr. William Gowland from the chair of metallurgy in the Royal School of Mines, it is announced that Mr. W. A.

Carlyle, lately general manager of the Rio Tinto, has been selected as his successor. We felicitate Professor Gowland on the affectionate esteem he has won from his students and the usefulness of the work accomplished by him as a teacher at South Kensington. To Mr. Carlyle we extend congratulations on an appointment both honorable and important, with best wishes for the highest success in the exposition of the metallurgical principles which he is so well qualified to elucidate.

WE NOTE with interest that a bill has been introduced in the Montana legislature embodying a suggestion appearing in these columns last November. Immediately after the presidential election we referred to the loss of the suffrage on the part of those whose business takes them away from home. The Montana bill recognizes that commercial travelers, railroad employees, stockmen, and others are necessarily absent from their voting precinct on election day and allows them to vote by mail. Proper safeguards are provided. There is even less danger of misrepresentation than in making a payment of $10,000 in the ordinary way by check sent in a letter. We hope the bill will pass.

Steel Prices.

Spectacular depressions in the stocks of a single great corporation which in the nature of things can no more be expected to collapse than can the Government itself, compel attention, and suggest contrivance to achieve a hidden purpose. The wild selling of United States Steel securities during the week appears unwarranted by industrial conditions. It is true that an enormous decline in production has been continuing for more than a year, and it is also true that the production of other metals has been out of balance with the shrinking output of iron and steel. The most conspicuous case in point is that of copper, in which an increase of 8.3 per cent occurred last year over the production for 1907, while during the same period the decrease in iron ore mined and smelted amounted to 36 per cent. The Steel Corporation, from its pre-eminent position as controller of a commodity upon which the complex industries of modern life so vitally depend, should have regulated and strengthened the business activities of the country. Instead of that it has stood as a menace and a deterrent through arbitrarily sustaining prices at a high level, without giving guarantees against change in the schedule for a definite period. It was reported that the independent steel manufacturers prevented action of this kind some months ago, but that is difficult to believe. The independent steel-makers were in too perilous a predicament from the financial depression wilfully to provoke further unsettling of business conditions. It requires no large intelligence to appreciate the impossibility of a normal revival of industry in the face of uncertainty in the price of a necessary element like iron and steel. Unless the price rule steady for a reasonable time manufacturers and dealers cannot accept orders save for immediate delivery. Large business is not done in that way. The time-factor is vital in enterprises of magnitude, and revival from a financial crisis is not accomplished through hand-to-mouth transactions. The independent steel producers beyond doubt would have welcomed such regulation of prices; manufacturers everywhere were pleading for it; the cry was universal for certainty, for fixedness, even on a higher plane of prices if need be, so that estimates might be made and contracts entered into with security.

What restrained the Steel Corporation from taking so salutary a step can only be surmised. To lower the price would have been a confession anticipating Mr. Carnegie's explosive dictum; to advance it would have stimulated the attacks of those who insisted upon a reduction of the tariff. It is certainly significant that the present bear movement has come at a most opportune moment to intimidate Congress. No reduction in the tariff on steel will be sanctioned by a public repentant after such financial castigation as it has just received. Resistance of the paper storms produced by Wall Street's tampering with the barometer will come only when men learn to trade in the substance rather than the shadow. Whether premeditated or not, the effect of the Steel flurry in deterring Congressional action is inevitable, wherein we see how dissimilar is protection from pampering, and what widely different degrees of avarice they excite.

Geological Hierophants.

"According to the quantitative classification, this rock belongs to monzonose, the sodipotassic subrang of the domalkalic rang of the perfelic order of dosalane. It is, however, near the border between the domalkalic and peralkalic rangs, and a relatively small increase of the alkali percentage would throw it into the subrang ilmenose. It is evident that the larger part of the albite molecules enter into the composition of the perthitic alkali feldspar; if most of them went to the formation of plagioclase crystals, the rock would have a monzonitic habit."

It looks vicious, undoubtedly; you wonder what has happened. At first, the compositor is debited with undisciplined exuberance, but you decide that the frills are too orderly to arise from mere typographical error and you begin to surmise that the supper last night has affected your eye-sight by way of your liver. Something is wrong. Either you are a hopeless idiot or the other fellow. And it is not the other fellow. This is a scientific cryptogram. The sentence serving as a text for these disjointed remarks is taken bodily from page 49 of Professional Paper No. 62, recently issued by the United States Geological Survey. The monograph so designated is devoted to 'The Geology and Ore Deposits of the Coeur d'Alene District, Idaho', and it was prepared by Messrs. F. L. Ransome and F. C. Calkins.

It is obvious that the information contained in the statement above quoted must prove of great value to the citizens of Idaho, and we can imagine our friends at Wardner and Wallace expressing their gratitude forcibly, if inelegantly, for so illuminating a chunk of geologic science. But, coming to plain talk, is it

not an impertinence to inflict the average citizen with such sesquipedalian verbal gymnastics? The reports of the Survey are intended primarily for the use of the people in the mining district serving as the subject for investigation, and after them for people interested in mining geology in the United States, and finally for scientific men. We confess that, belonging to two of these classes and in cordial sympathy with the third, we found ourselves first astonished at the terminology of the paragraph quoted and then we deemed ourselves flouted by the authors, for it is unpleasant to be made to feel like an ignoramus. Having heard of a new classification of rocks that had been invented by Messrs. Cross, Penfield, Washington, and Iddings, we guessed the clue, that is, we knew where to get the code-book. Thereupon we went to a University library, and after rummaging on three floors of that museum of learning we finally found Volume X of the *Journal of Geology*, wherein the key to these verbal monkey-shines is hidden. A group of four petrographers occupied the spare moments, devoted by lesser men to harmless dissipation, in concocting a quantitative chemical classification of rocks, and for this purpose they divided the rock-forming minerals into two groups, namely, the silicious, alkali-, and calci-aluminous, which they labeled *salic*, and the ferro-magnesian, which was labeled *femic*, much in the same way as the Coniagas mine at Cobalt was christened from the first two letters of the chemical symbols that stand for the elements cobalt, nickel, silver, and arsenic. The subdivisions, named *rangs*, are founded on the chemical character of the bases in the minerals of the preponderant group in each case; the lowest division is called a *grad*, and for finer work *subrangs*, *subgrads*, and so forth, were invented. If a factor is extremely abundant the prefix *per* is used; if only dominant, then the prefix *do* or *dom*—at this stage the Irish pronunciation of a more familiar term will be readily on the reader's lips. But he must not be so easily discouraged. 'Fel' is a mnemonic of feldspar, so that *felic* means feldspathic, and *perfelic* means particularly, deliciously, and astonishingly feldspathic—do you see the game now? Terminations *-ane* and *-one* indicate a class and a sub-class, as *-ase* and *-ose* indicate a *rang* and a *subrang*. We are informed (and this is consoling) that "these terminations were selected after trial of many that were suggested." Cheer up, you don't know what you escaped! Of course, we are aware that from the standpoint of the petrographer the quantitative chemical classification of the petrographical trust affords a neat and satisfactory system of description, but the reports of the Survey are not intended primarily for petrographers, but for laymen, that is, for the general public interested in mining, or, to put it even plainer, for the taxpayers who pay for the preparation of the reports. Anyway, is it not all plain as a pikestaff; you ask what mozonose is: well, have not Messrs. Ransome and Calkins told you explicitly and in the abracadabra of speech that it is a "subrang of the domalkalic rang of the perfelic order of dosalane," and if you are still in doubt, cable to Bedford McNeill for his codebook.

The Institution of Mining and Metallurgy.

The eighteenth annual report of the Institution of Mining and Metallurgy indicates the continued growth and prosperity of this society of engineers. While the membership is not big, it is representative of the best elements in the profession, not only in England but wherever British capital is invested in mining. In consequence, a large sprinkling of Americans is included, giving the Institution an international scope. At present 1800 names appear on the list of members and associates, indicating an increase of 1298 in ten years. But mere numbers do not constitute strength, for that we must look to the quality of the transactions of the society and to its tonic influence upon the profession. In these respects the Institution has done well. Although in some subjects, such as economic geology, the American Institute is still ahead, it is gratifying to note an increase of contributions on ore deposition, while in contributions concerning cyanidation, sampling of mines, and underground practice, the Institution has done splendidly. On the whole, however, the most important work accomplished has been the standardization of terms and the pronouncements on matters pertaining to professional behavior. The service done in these directions has been invaluable, and the general acceptance of the dicta issued from Salisbury House bears testimony to the respect which the society has won throughout the English-speaking world. This result is due, in large part, to the thoroughly representative character of the Council of the Institution; a technical society must be ruled either by a committee reflecting the character of its membership, or it must be managed by one man of strong personality and ability. Both methods possess advantages, but as men of first-rate ability willing to devote themselves to the service of technical societies are rare, it is well that they should be managed by a select oligarchy rather than a benevolent despot. A perfectly representative type of government, in societies as in national affairs, is desirable, but unfortunately, in societies as in nations, representative government in its perfect form remains an unattainable ideal. To these general statements we need only add that the group of men that controls the affairs of the Institution not only represents the best elements in the profession but, as far as we know, those men have used their power in the best interests of that profession. Of course, a membership of 1800 is small in proportion to the multitudinous mining activities of the British empire, and the Institution, as regards numbers, has not yet grown commensurately with the vast industry of metal-mining having headquarters in England. Through evolution by careful selection, a successful effort has been made to bar the irresponsible among those engaged in the conduct of mining affairs. Now that the Institution has won a deservedly commanding position, we hope all who are qualified will join, so that in numbers as well as in character this society may be fully justified in being considered the representative association of those taking an honorable part in the manifold technical operations directed from London.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

FRANK H. PROBERT is at Butte.

FRANCIS L. BOSQUI is at Tonopah.

J. H. CURLE is on his way to Kashmir.

NEWTON B. KNOX is on his way to Korea.

HAROLD RICKARD has moved to El Paso, Texas.

W. J. LORING is expected in London from Burma.

ERNEST WILLIAMS has left London for Kalgoorlie.

ROBERT A. KINZIE, of the Alaska Treadwell, is here.

JOHN A. RICE, of El Paso, is now in Sinaloa, Mexico.

E. A. MANNHEIM is on his way from London to Brazil.

JOHN H. HUGHES, of Fairbanks, Alaska, is in London.

A. R. WEIGALL has returned to Australia from Korea.

E. J. FRANZ has returned to Plumas county, California.

A. G. KIRBY, of Reno, Nevada, was recently at New York.

EDWIN H. MESSITER was in San Francisco on his way to Oroville.

HIRAM W. HIXON has returned to Canada, after a visit to London.

F. F. SHARPLESS passed through San Francisco on his way to Butte.

P. GEORGE GOW has returned to San Francisco from a holiday in Europe.

PERCY E. BARBOUR is designing a mill at Minas Nuevas, in Sonora, Mexico.

JAMES M. HOLMAN, of Camborne, Cornwall, is spending a holiday in Egypt.

HUGH C. WATSON has gone from Goldfield to Mapimi, in Durango, Mexico.

WALTER W. BRADLEY has returned to Berkeley, Cal., from Ventanas, Mexico.

L. K. FLETCHER has obtained a position at the Karma mine, near Mojave, California.

ALLEN C. REDDING, of San Francisco, is now examining mines near Barstow, California.

WAGER BRADFORD has been appointed manager of the Robinson mine, at Johannesburg.

GELASIO CAETANI has left Treadwell for the Bunker Hill & Sullivan mine, at Kellogg, Idaho.

DAVID COLE is assistant manager to the Cananea Consolidated Copper Co. in Sonora, Mexico.

W. C. RALSTON has been elected a vice-president of the American Institute of Mining Engineers.

GEORGE E. WEBBER, general manager for the Rand Mines, Ltd., is about to leave the Transvaal, returning to California.

F. H. HATCH has been engaged by the Government of Natal to report on the mining possibilities of Natal and Zululand.

E. S. PETTIS has returned from the Soledad mine, Mojave, and is now with the Butters Patent Vacuum Filter Co., San Francisco.

WALTER FITCH, until lately superintendent of the Calumet & Hecla, has taken charge of the Little Chief mine, at Eureka, Utah.

E. E. CARPENTER has left the Belmont mill, at Millers, Nev., and has taken charge for the Just Mining & Extraction Co., at Goldfield.

HENRY M. ADKINSON has returned to Denver from Telluride, Colorado, where he has been inspecting the properties under his management.

H. VINCENT WALLACE and M. W. SUMMERHAYES, of Nogales, Arizona, have opened a branch office at Patagonia, with C. W. MORGAN in charge.

Latest Market Reports.

LOCAL METAL PRICES—February 25.

Antimony	12@16c	Quicksilver (flask)	44@45
Electrolytic Copper	15¼@16½	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 18. £. s. d.	Feb. 25. £. s. d.
Camp Bird	0 16 6	0 15 9
El Oro	1 3 9	1 3 9
Esperanza	3 0 6	3 1 3
Dolores	1 10 0	1 10 0
Oroville Dredging	0 11 0	0 11 3
Mexico Mines	4 17 6	4 12 6
Tomboy	0 18 9	0 17 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Feb. 19	12.87	4.01	4.85	50¾
" 20	12.75	3.98	4.82	50¾
" 21	Sunday.	No market.		
" 22	Holiday.	No market.		
" 23	12.62	4.00	4.82	50⅜
" 24	12.56	3.97	4.80	50⅞
" 25	12.50	3.97	4.77	50⅜

SOUTHERN NEVADA STOCKS.

San Francisco, February 25.

Atlanta	$ 12	Midway	22
Belmont	84	Montana Tonopah	75
Booth	19	Nevada Hills	1.40
Columbia Mtn	13	Ophir	1.25
Combination Fraction	99	Pittsburg Silver Peak	76
Daisy	65	Rawhide Coalition	44
Fairview Eagle	10	Rawhide Queen	40
Florence	3.75	Round Mountain	85
Goldfield Con	8.00	Sandstorm	13
Gold Kewenas	19	Silver Pick	9
Great Bend	19	St. Ives	15
Jim Butler	16	Tonopah Extension	70
Jumbo Extension	16	Tonopah of Nevada	6.00
MacNamara	34	Tramp Con	10
Mayflower	16	West End	33

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Feb. 18	Feb. 25.
Amalgamated Copper	73⅜	66⅛
American Smelting & Refining Co	85⅛	79¾
Boston Copper	12	11⅜
Butte Coalition	23	21½
Cumberland Ely	8⅛	7½
Dolores	6¼	5½
El Rayo	3¼	2⅞
Giroux	7½	7
Greene-Cananea	10¼	9½
Indiana Sonora	3¾	3¾
La Rose	6½	6⅛
Miami Copper	13½	12⅞
Nevada Consolidated	18⅛	16½
Newhouse	4¾	4¼
Nipissing	9¾	9¼
Ohio Copper	6⅞	6½
Tennessee Copper	39⅛	36½
Utah Copper	43⅜	
Yukon	4⅝	4¼

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. February 25.		Closing prices. February 25.
Adventure	7½	Mass	5¼
Allouez	40½	Mohawk	60
Arcadian	5	North Butte	67¼
Atlantic	15½	Old Dominion	42
Calumet & Arizona	99	Osceola	130
Calumet & Hecla	620	Parrot	26½
Centennial	30	Santa Fe	2
Copper Range	71	Shannon	13¼
Daly-West	9½	Superior & Pittsburg	14⅛
First National	7	Tamarack	86
Franklin	13	Trinity	12½
Granby	94	United Copper Con	11
Greene-Cananea, ctf	9½	Victoria	4½
Isle Royale	30⅞	Winona	5¼
Lake	17	Wolverine	140

(By courtesy of E. F. Hutton & Co., 490 California St.)

General Mining News.

ARIZONA.

COCHISE COUNTY.

At a depth of 120 ft. the Centurion Mining Co. has found a crevice in the rock at the bottom of the shaft through which there is so strong a current of air that the miners are able to descend the shaft within five minutes after firing a round of shots. The company has also found ore worth over $20 per ton.

GILA COUNTY.

In the Eureka shaft of the Arizona Commercial Copper Co. a cross-cut from the 700-ft. station to the Black Hawk lode has run into ore averaging 6% copper. It will be drifted on both ways. The raise from the 560-ft. intermediate level has been holed through and a connection made with the fifth level. A winze has been started, from the bottom of which a drift will be driven west to connect with the Eureka shaft, about 650 ft. distant.

PINAL COUNTY.

The diamond-drill holes at the mines of the Ray Consolidated Copper Co. indicate the presence of about 15,000,000 tons of ore averaging 2.5% copper. Immediately adjoining the Ray Consolidated property, and in the same porphyry belt, is a series of claims in which about 2,000,000 tons of ore have been blocked out. A new company has been formed, known as the Ray Central Copper Co., to acquire these claims from the Kelvin-Calumet Company.

YAVAPAI COUNTY.

(Special Correspondence).—The adit belonging to the Hull Copper Co. has now been completed by reaching the 1888 claim with a length of 4680 ft. Work was started several years ago by Ralph Dillon, in memory of whom the adit will be locally called the 'Dillon Tunnel.' In driving it several bodies of good ore have been found, some of which now lies on the dump ready for the company's small smelter to treat.——The Verde Grande Co. has now sunk its main shaft 838 ft., and has been cross-cutting at the 800-ft. level. The east drift has advanced about 500 ft. in a vein that looks promising.——The 10-stamp mill and cyanide plant of the Etta mine in the Cherry creek district has been completed, and will be started early in March. H. H. Keays is superintendent.

Prescott, February 18.

This week at Prescott, before Judge Sloan, the Blue Ridge *v.* Tom Reed mining case was further threshed out. The defendant company moved to dissolve the injunction recently issued by the Court Commissioner and the motion prevailed. T. E. McClelland, of Kingman, and ex-Governor Charles S. Thomas, of Colorado, appeared for the Blue Ridge people, and Norris & Ross for defendants. Upon amendment of complaint along the lines laid down by the Court another clash will probably take place.

CALIFORNIA.

NEVADA COUNTY.

A complete survey of the 500 and 700-ft. levels of the Idaho-Maryland mine has been made, and an ore-shoot has been discovered which Bray Wilkins, the manager, says is a new orebody, with well defined walls, lying parallel to the old vein.

SHASTA COUNTY.

The annual report of the First National Copper shows the operation of the smelter during a portion of three months. In 53 days there were treated about 26,000 tons of ore, most of which came from Balaklala. The average copper content of the ore was 2.7%, and the total cost of production is indicated at about 10c. per lb., which is quite satisfactory for preliminary operations of a smelting plant.

SISKIYOU COUNTY.

Placer mining is booming along the Salmon river in consequence of the abundance of water. The Johnson flume below Sawyer's Bar is finished, and nearly ready for operation; the Bonally Co. have 35 men at work completing their ditch line; and the Bennett Co. are now hydraulicking five placer claims at the Forks of the Salmon.

TUOLUMNE COUNTY.

One hundred men are working on what is reported to be good pay-ore in the mines of the United Mines Corporation. The properties include the Grizzly, New Albany, Lady Washington, and Dead Horse. On the 300-ft. level of the New Albany a good strike of ore has been made; the corporation is going to operate another of the mines near Carters, the Old Dead Horse, which in former times was developed down to the 1500-ft. level.

YUBA COUNTY.

The lawsuit over the Solano Wonder gold mine at Brownsville has been decided at Marysville in favor of J. C. Campbell and his wife. It appears that J. Lang and B. F. Ream took out 60 sacks of ore from a piece of ground which they believed to be Government land, and subject to location. Ascertaining that the find was made close to their old abandoned shaft, the Campbells had the ground surveyed and found that the Solano Wonder was on their own patented land, and have now obtained judgment for the sacks of ore extracted, together with $1000 damages.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The Philadelphia M. & T. Co. has been organized with a capital stock of $1,000,000 by H. E. Woodward, J. V. Wood, and H. W. Robinson, and the principal office will be maintained in Denver. A group of claims on Kelso Mtn. has been purchased from J. T. Hamill and work has already been put under way. The adit 500 ft. long is to be advanced at least 1000 ft. farther to cut the veins at depth. A plant of machinery is to be installed in the spring.——G. Laughlin, of Chicago, representing a syndicate of Eastern capitalists has taken over the Magnet group of mines on Saxon Mtn. The bond calls for $80,000, and it is understood that a cash payment of $20,000 has already been made. Laughlin has also entered into negotiations for the rental of the Doric adit, and the papers will be signed as soon as the stockholders residing in London have been communicated with. Working capital has been subscribed and it is expected that actual operations will be under way within 30 days. The Magnet mine was never worked to a depth exceeding 600 ft., and where the vein was intersected through the Doric adit a body of smelting ore was exposed that is from 1 to 4 ft. wide. A stope was carried for 175 ft. and the lowest returns ever received in settlement on ore were $29 per ton in gold, silver, and copper, while returns of $174 per ton have been realized on the first-class product.——The McClellan Mtn. M. & M. Co. is working in a diligent manner upon the Vesper group of claims in East Argentine. The adit has been extended 725 ft. and during the last week the Vesper vein was intersected. Scattered mineral is showing, and drifting has been been put under way to prove the ground. This company is being financed by Minneapolis capitalists and enough funds have been provided for development. The work is being performed under contract by H. Davenport. ——William Rogers, of the Santiago, has been adding to the working force during the last week. Much development has been planned for the fourth and fifth levels and shipments of both smelting and concentrating ore are to be made to the Santiago mill in Georgetown. As soon as the weather permits work will be started on the construction of the new aerial tramway which will run from the fifth level of the mine to the mill in Georgetown. The tram will be about three miles long.

Georgetown, February 20.

GILPIN COUNTY.

Sinking operations are being carried on at the Poole shaft of the Gilpin-Boulder Consolidated Mines Co. in Lake gulch and a depth of 40 ft. has been reached. The bottom of the shaft shows a 2½-ft. vein, of which 8 in. is a smelting streak,

the remainder being free-milling ore. At present the entire vein matter is being sent to the stamp-mill. E. H. Crabtree is superintendent.——A shipment of several tons of smelting ore from the Baxter mine on Quartz hill has brought returns of $85 per ton. The property is owned by McFarlane Bros., and has been idle for a number of years, but was recently started up under a lease to Moe & Co.

GUNNISON COUNTY.

A. E. Reynolds is enthusiastic about the Gold Links mine, near Ohio City. He has about 50 men employed in the mine and mill and has just installed a 12-drill compressor to assist the development at the end of the 3300-ft. adit.

LAKE COUNTY.

A diamond-drill connection has been made between the No. 1 and 3 shafts of the Ibex property, through which the water of the No. 3 will drain into the other shaft, and thence out through Yak 'tunnel' into California gulch.——Many of the Leadville mines are in a serious predicament on account of lack of fuel, due to railroads being stopped by snowdrifts. Those mines served by electricity have been in no way hampered, and this has caused several managers to consider protecting the steady operation of their properties by such an installation.

SAN MIGUEL COUNTY.

Gustav H. Schwab, vice-president of the North German Lloyd, has asked the United States District Court of Telluride for an injunction against the Smuggler-Union, the Tomboy, and the Liberty Bell mines to restrain them from emptying their tailing in the San Miguel river and thereby ruining his placer grounds. Schwab's claim is that the tailing from the defendant mines turn the San Miguel into liquid mud. So muddy is the water that it is impossible to use it in placer operations. The tailing also covers a great deal of his ground with deep sediment. The farmers are also lending their support, as the water is rendered bad for domestic purposes.

TELLER COUNTY.

In the first fourteen days of February 170 ft. have been driven in the Roosevelt Deep Drainage tunnel. The official measurement of the total length on February 9, shows 3625 ft. as having been accomplished, indicating 302 ft. as the average length driven per month.——A five years' lease has been secured by M. B. Burke for the Henry Adney Gold Mining Co. of the properties of the Black Belle Gold Mining Co. on Beacon hill. The Black Belle claim is at present under a lease expiring on May 1. Under the lease conditions the shaft must be sunk an additional 200 ft. from the present depth of 400 ft. It is Burke's intention to install an electrically driven compressor and to develop the property with machine drills.——A new vein on the property of the Gold Dollar Consolidated Co. has been opened up by C. G. Jackson, of the Union Leasing Co., by a cross-cut east from the 400-ft. level of the Mable M. shaft. The new orebody measures 8 ft. between walls and mine samples assay from $10 to $38 per ton.——An Illinois company, represented by Spratt Bros., operating at the head of Barnard creek, about 1½ miles northwest of the town of Gillett, is reported to have opened up 'pay' ore on its property.——An electric hoist is being installed by the La Bella Investment Co. on its lease on the Pueblo claim of the Free Coinage Gold Mining Co., east of the town of Altman. A new shaft-house is also under construction and the general manager, W. Wilson, will commence sinking an abandoned shaft on the Pueblo, now about 60 ft. deep, in search of an ore-shoot in that immediate neighborhood.

IDAHO.

LATAH COUNTY.

The present workings of the Inland Copper Co.'s property, 8 miles east of Troy, are down 160 ft. and a 20-ft. vein has been tapped; but the greater part is oxidized with the copper leached out, leaving a porous quartz with iron sulphides and some ribbons of rich copper ore. The company has done 1000 ft. of development work and hopes to find better copper ore in depth.

NEZ PERCE COUNTY.

Fifteen mineral claims carrying veins of asbestos were located in June 1908, the claims being staked off and appropriated in compliance with the provisions of the laws of the United States. It now appears that the lands were not subject to entry, but are lands belonging exclusively to the State of Idaho. The State Board of Land Commissioners of Idaho is now being besieged by applicants desiring leases of those lands which are believed to contain minerals. The applicants will probably obtain them on certain conditions of paying royalties.——The Ozark Mining & Milling Co. has just completed plans for a 100-ton mill and is driving an adit on the Wild Rose claim to cut the vein at a depth of 500 ft., the greatest depth ever attained in the Pierce district. The adit will be approximately 1200 ft. long, of which 775 ft. have already been done. The company has been engaged in development work for the last two years, during which time $70,000 have been spent.

SHOSHONE COUNTY.

(Special Correspondence).—The principal feature of interest during the past week has been the suit of David Hyman, of New York, against the Frisco Mining Co., in which a default has been entered in the District Court. The suit was for the purpose of foreclosing a mortgage of $150,000 on the mine, mill, machinery, and claims of the company. The property will now be sold at the sheriff's sale, and it is regarded as certain that Hyman will be the buyer. The mine and mill used to give employment to about 400 men when working at full capacity.——A financial statement has been issued by the Pittsburg Lead Mining Co., covering the period from January 1907 to September 1, 1908. According to this the receipts of the company during that time amounted to $199,333, of which about $180,000 was from the sale of ore. The expense of exploration and development came to about $87,000 and operating the mill cost about $10,000. An arrangement has been made by which the stockholders will advance money to the company at the rate of 5c. per share.——The new offices of the Bunker Hill & Sullivan Mining Co. have practically been completed, and it is expected that the company will take possession during the coming week. It is believed that the completion of these offices makes the B. H. & S. the best equipped company in this part of the country.——Two 2-drill air-compressors have been installed on the property of the Coeur d'Alene Consolidated Co. The power is furnished by a flume over a mile long. Contracts for 300 ft. of development work have been let by the management, and it is hoped that this will be enough to reach two veins which traverse the property. ——The United States Deputy Mineral Surveyors, who have been in convention in Wallace for the past few days, have formed themselves into an association to be known as the 'Association of Engineers of North Idaho.' The organization is the result of a suggestion made by Darwin A. Utter, Surveyor General for Idaho. The officers chosen are as follows: president, G. Scott Anderson; vice-president, R. S. Merriam; secretary, A. E. Robinson. The executive board consists of C. F. O. Merriam, A. E. Robinson, and Frederick V. Phinney. It is the intention to hold regular annual and monthly meetings at which all matters connected with surveying of mineral lands, etc., will come up for discussion.

Wallace, February 18.

Harvey M. Ross, one of the owners of the Sidney group of claims on Pine creek, adjoining the Nabob mine, reports that the vein has been struck in the adit now being run in the Sidney. This vein was first seen in the centre of the creek, but water prevented operating there, and a cross-cut was started higher up. When first uncovered there were showing three feet of good ore carrying galena and zinc.

MICHIGAN.

It is rumored here that a deal is under way to consolidate the Ahmeek and Seneca mines, making a company with 100,000 shares. Ahmeek is understood to be financing exploratory work now under way at Seneca.——Record progress is there being made in shaft sinking and cross-cutting at the Seneca mine. The cross-cut is now in about 43 ft.,

and driving is being done at a rate that should disclose the Kearsarge lode within a week.——Allouez has encountered the Kearsarge lode in the cross-cut on the 14th level of the No. 2 shaft. The first round of blasts showed excellent copper ground. The company will continue cross-cutting until the foot-wall is reached, when sinking on the lode will be resumed. Arrangements are now being made to turn the shaft to conform to the dip of the lode.——Victoria reports a decided improvement in the bottom of the mine, where drifts are working into ground exceptionally rich in mass copper.——The coming spring will undoubtedly see active work started in sinking Mohawk's No. 6 shaft, between No. 5 and the Ahmeek boundary. The shareholding public has greater faith than ever in the Mohawk mine's future prospects.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—In the American Davey mine at Prosperity a second steam-shovel is to be installed at once. The first steam-shovel in the district was used here and proved a success. The shovel cannot be used in all these mines, as it requires ground where there is no timbering or where very few pillars are left, and where there is sufficient room for a large shovel to work. The new machine will embody several improvements on the former model, as the company has been making a careful study of the machine to see wherein it could be improved.——An interesting experiment is being conducted in Poor Man's



Florence Mill, Goldfield.

gulch near Joplin by the Poverty Mining Co. A large concentrating plant handling 200 tons has been erected for treating the old dumps of the mines worked 14 years ago. It is thought that a considerable percentage of zinc-blende can be recovered from these sources, as the inadequate facilities of those days did not permit of saving low-grade ore.——Another drill strike in the Midway camp near Joplin is exceptionally rich. In the area of one acre several drill-holes have been sunk showing a run of ore beginning at the 50-ft. mark. The first 20 ft. is galena, while a 9-ft. bed of zinc-blende occurs below this. The strike is near the old Cardinal mill on the Conqueror lease, once one of the bonanzas.

Joplin, February 18.

MONTANA.

MADISON COUNTY.

The American Goldfields Co. has been organized in Spokane with a capitalization of $1,000,000, to develop a group of claims 12 miles from Alder creek. The officers of the company are: N. Valentine, Harry J. Gibbon, F. C. Hickok, and Frank C. Lavigne. The property has been operated more than five years, but owing to the shortness of the season the owners were unable to realize profits. The equipment, which represents an expenditure of $18,000, consists of ditches, flumes, pipe-lines, and hydraulic giants. The company will construct a reservoir and dam for the storage of water, in the hope that this will lengthen the season and permit operation at least nine months of the year. The company owns four miles of bottom lands which yield 40 cents per yard.

SILVER BOW COUNTY.

Charles Cote is doing a good business at Butte by collecting discarded tin cans all over the State and selling them as material for the copper precipitation plants. To prevent unwieldy bulk, the cans are compressed in a hay-baler, and make very suitable material for the precipitation process.

In the course of his testimony before Judge Hunt in the Federal Court, E. P. Mathewson made the statement that 90% of all the ore received at Washoe is concentrating ore and only 10% goes direct to the furnaces. The ore yields in arsenic all the way from a mere trace to 2½%, and an average amount of two tons is recovered daily. He further said that every method of eliminating arsenic from the smoke had been investigated, and that the system now in use is about as perfect as can be made. At Great Falls a new method is being tried, and if it proves more successful than the process now in use at Washoe, it will be substituted at the latter plant, although the change would cost the company over $2,000,000.——The shaft of the Diamond mine of Anaconda has reached a depth of 2400 ft. and has passed through ore near the bottom. Sinking is still going on.——A test run has been made with the East Butte Co.'s new concentrator, with results that demonstrate the feasibility of a principle that may revolutionize concentration. The method is being kept a secret, but the system is said to be automatic, very economical and simple, and will concentrate the lowest grade of ore.——A cross-cut on the 2000-ft. level of Parrot has just entered the vein at a distance of 500 ft. from the shaft and the heading has reached ore. The vein on the 1900-ft. level though wide is disappointing in value.

NEVADA.

CHURCHILL COUNTY.

The installation of the new 15-hp. Fairbanks-Morse hoist has been completed at the Mary H. claim of the Jessup Mines Co.'s estate, where a 2-compartment shaft is being sunk to the 200-ft. level.

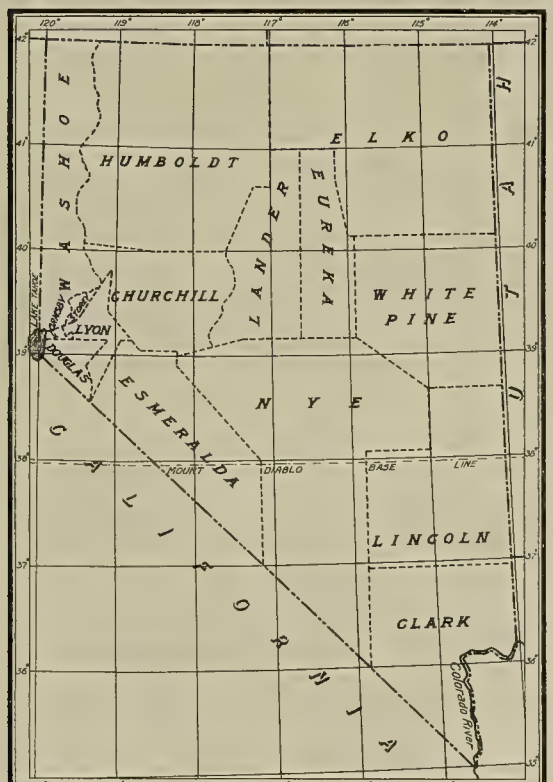
ESMERALDA COUNTY.

The officials of the Goldfield Consolidated Co. have unearthed a complete counterfeiting plant equipped with furnace, dies, a press for stamping out coins, engravers' tools, etc., for forging time checks, whereby the company is supposed to have lost some thousands of dollars.——One hundred men are now on the pay-roll of the Florence Goldfield Mining Co., and more are being added as fast as the enlarging of underground operations will justify. It is probable that by the first of March, there will be fully 80 men in the underground workings, in addition to the mill and other employees on the surface. Thomas G. Lockhart says there are only three sets of lessees working on the Florence, and when their time is up he does not expect to do any further leasing.——The *Goldfield News* estimates that there are 1536 men employed in the mines and mills of the district, obtaining an average monthly pay of about $184,000, of which the Goldfield Consolidated Co. alone contributes $68,000 per month.——It is rumored that an immense body of ore has been opened on the 600-ft. level of the Combination Fraction workings, and it is believed to be the continuation of the Loftus, Davis & Sweeney orebody which made some remarkable history in the early days. Eight power-drills are being used in development, and an average of about 75 tons of ore per day is being treated at the mill of the Nevada-Goldfield Reduction Co.——Leadville is the name of a new camp some 10 miles southwest of Candelaria, where R. D. Edwards and about 17 men are working on ore which carries silver and lead.

NYE COUNTY.

R. B. Respess, of New York, has been in Bullfrog making further investigations with a view to erecting a milling

plant at Gold Centre. The water-supply at that point is found to be excellent, and as soon as Respess finds that 300 tons of ore can be obtained daily, he will be prepared to set work under way for a mill of about that capacity. With Respess is associated W. D. Lawton, who will have charge of the construction work.——The Homestake King mine shipped $16,000 in bullion as the result of the January run of the mill. Slightly more than 2000 tons of ore were treated during the month, as compared with 1500 tons, resulting in $12,000, for December. The cyanide plant is now in efficient working order. S. B. Tyler assumed charge of the Homestake mine and mill on February 10.——The Tonopah Mining Co. sent 3050 tons, the Belmont 950 tons, the Montana-Tonopah 779 tons, the Midway 100 tons, the MacNamara 250 tons, West End 200 tons, and Jim Butler 300 tons to the mills, making the total shipments for the week 5629 tons. With shipping ore valued at $60 per ton and milling ore at $25 per ton, the total estimated values of this output is $140,000.——The Tonopah Mining Co. has recorded



Nevada, Showing the New County.

an advance in development work of 506 ft. for the week, of which 361 ft. were done in the Mizpah. A drill-hole is being put down from the 740-ft. level of the Silver Top, and has now reached a point 437 ft. below that level. The Red Plume shaft is now about 500 ft. deep, and sinking is being continued in order to reach a good body of quartz discovered in one of the diamond-drill holes.——At the Belmont work has been done blocking out the orebody on the 1100-ft. level, and up to date its total extent has not been fully ascertained, although several raises have been put up connecting with the 1000-ft. level. What new ore has been discovered in the general development of the mine has proved to be of a most satisfactory nature.——The Round Mountain Hydraulic Mining Co. is working three shifts on its Blue Jacket placer claim. About a month ago it started a 2-in. giant, and has kept it going night and day ever since. Superintendent Benkie is in charge, and will have another giant at work before long. The stream is directed upon a bank from 3½ to 6 ft. deep which shows gold almost through its entire depth.

NEW MEXICO.

GRANT COUNTY.

About a year ago H. W. Baylor and H. J. Bowles, two cattlemen of Uvalde, Texas, grubstaked W. Q. McKinney to go to Sylvanite, where he located the Pearl and Monte Christo, two adjoining claims, in the southeastern part of the district. The vein has been opened up within the last month, and a number of splendid pieces of 'specimen' ore have been uncovered. The vein is of granulated quartz, 30 in. wide, impregnated with free gold, and on the foot-wall side is decomposed slate which also gives good assays of gold.

OREGON.

MALHEUR COUNTY.

A well had been driven 2210 ft. at Ontario, when suddenly a terrific explosion of mud, water, and pebbles took place from the hole, followed by a stream of gas which is now escaping with great violence. Until the necessary tools for capping can be obtained this will all be wasted. The discovery of gas has much elated the people of Ontario, for it is expected that oil will soon follow after.

UTAH.

SUMMIT COUNTY.

A snow block on the 'high line' caused a suspension of operations at the Daly West mine and mill, several shifts being lost on account of the lack of coal. The men at the loading station soon cleared the engines from snow, and opened traffic. The aerial tram at the Silver-King works well in any kind of weather, and it was not necessary to close down at that property. The road to the Daly Judge has also been kept open, and work has been continued there as usual.

WASHINGTON.

FERRY COUNTY.

Thirty men are being employed at the Napoleon mine, situated about 8 miles southeast of Orient. It belongs to the British Columbia Copper Co., and, containing an excess of lime and iron, is useful for the Greenwood smelter as a flux for the other ores received. The shipments now are approximately 150 tons per day, sent from the mine to the railroad by an aerial tramway.——The New Republic Mining Co. has shipped 3 carloads of ore, and has increased its force to 37 men, many of whom are carpenters engaged in erecting the new machinery.——The Mars Hill Mining Co., operating near Rockcut, recently struck a fine body of galena about 800 ft. along the adit of the Jennie mine. The shoot is 8 ft. wide and is associated with chalcopyrite which carries gold.——The Kettle River Mining Co. is increasing its equipment with a boiler, hoist, and sinking-pump. At a depth of 50 ft. the shaft has come upon a shoot of chalcopyrite and silver-lead ore asaying $125 per ton. The mine is close to the Spokane Falls & Northern railway, and has E. L. Allen as superintendent.

STEVENS COUNTY.

The McKinley Mining Co., now developing the Dewey claim, has been cutting through a vein for 26 ft., but has not yet reached the hanging wall. Mr. Ekstrom, the president, has been at the mine during the past four weeks.——The Verde Antique marble quarry, at Valley, and the Columbia River Marble Co.'s quarry, near Bossburg, are reported to have passed into the hands of Allan Haynes, an Eastern capitalist, and a new company will be organized to operate these properties in the spring.

SPOKANE COUNTY.

The Idaho-Knickerbocker Mines Co. has been incorporated in Spokane, with a capitalization of $1,500,000, by W. H. Winfred and J. M. McCroskey, to take over the Charles Dickens property, in the Coeur d'Alene, which was acquired by A. D. Gritman of Spokane at a sheriff's sale some time ago. It was given out that 55 shareholders in the Charles Dickens Co. have subscribed two-thirds of the amount, while 250,000 shares were taken up by stockholders in the new company. The first named have until December 3, 1909,

to redeem the property, upon which thousands of dollars have been expended in development work.

AUSTRALASIA.

The director of the Government Geological Survey states that the discovery of a coal seam at Powlett river is the greatest mineral discovery made in Victoria for 25 years, and will ultimately make Victoria independent of the other States in regard to coal. The quantity of coal available in the new field may be computed, according to the same authority, with the greatest safety at from 10 to 20 million tons.——The Waihi Gold Mining Co. of New Zealand is substituting gas for steam as motive power, to a great extent. At the Waikino mill five 200-hp. Crossley gas engines, together with five others aggregating 175 hp., have been installed, leaving a 520-hp. steam-driven engine to drive the 200-stamp Victoria mill.

CANADA.

BRITISH COLUMBIA.

The mild weather of the past few days has enabled operations to be resumed on mining properties near Kamloops. At the Iron Mask there is a good force of men, while on various other claims clearing work is being done. H. Beckman, owner of the Copper King and Kimberly, has engaged a force of men at the latter property to sink a shaft, while at Copper King the regular staff of eight men is retained. ——A shipment of 500 sacks of ore from the Early Bird mine, on Moresby island, to the Tacoma smelter gave returns of over $60 per ton, while another from the Cornell mine to the Tyee smelter netted over $20 per ton after paying all freight and smelting charges.——James McMartin, president of the La Rose Consolidated Mining Co. of Cobalt, has taken bonds on the Kootenay Belle and Mother Lode properties in the Sheep Creek camp, in the Boundary district, formerly owned by J. L. Warner, F. M. Black, and F. E. Morrison. The deal was closed after an examination of the property by William Watson, a consulting engineer. The Kootenay Belle adjoins the Queen mine and is almost opposite the Mother Lode. The two groups can be worked together. During the last months in which these mines have been operated, the ore from the Kootenay Belle has been milled, and the high-grade ore from the Mother Lode has been shipped to the smelter for treatment.——The accumulation of ore at the Trail smelter has now been got rid of, and various mines have been sending increased shipments. Developments at the Idaho, Iron Mask, War Eagle, and Centre Star mines continue with satisfactory results. The latter shipped 3000 tons of ore last week. In the Le Roi exploration is being made on the 1750-ft. level for the ore-shoot which is now being developed on the 1650-ft., and W. A. Carlyle, the consulting engineer for the company, is examining the mine to decide on the best method of operation.——Seattle and Boston capitalists are backing a scheme to build a large hydraulic plant on Ruby creek, in the Atlin district, this year.——A new coal mine is being opened at South Wellington, near Nanaimo.——Recent development of free-milling gold claims in the vicinity of Gold Harbor, on the west coast of Moresby island, in the Queen Charlotte group, has proved so satisfactory that the Nuba and Early Bird mining companies will jointly install a 20-stamp mill there early in April. The order for the plant has been placed in Germany.——Recent arrivals from the islands brought news that an English syndicate promoted by a Seattle man is busy diamond-drilling its coal claims on Graham island. Engineers, in charge of J. Kelley, have completed the survey for a proposed 15-mile railway from the coal basin to Charlotte City on the Skidgate.

D. A. Matheson, of the Yukon Basin Dredging Co., has closed a deal for a dredge costing $70,000, to be shipped North in a few weeks. At present this dredge is lying on the wharf at Vancouver, having been brought from Scotland by Richard Liepman some time ago.

MEXICO.

C. C. Brayton, who for the past year has been in charge of the Santa Francisca mine in Asientos, has gone to Guanajuato, where he will be connected with the Guanajuato Development Co., which is now under the charge of Cortlandt E. Palmer. Thomas M. Hamilton has succeeded Brayton in charge of the Santa Francisca at Asientos; he was formerly with the Braden Copper Co. of Chile.——The famous Dos Bocas oil-well, which for months shot a column of flame and smoke into the air for hundreds of feet, has been converted into a geyser, and boiling waters are being hurled up at the rate of 25,000 gal. per day, together with a quantity of volcanic stone.——The mines of the Chatterton Mining Co. in the Tapalpa district of Jalisco have been sold to William H. Baldwin, of Delavan, Illinois. The consideration named is $200,000. The Virginia and San Antonio mines are the principal properties of the Chatterton group. There is a 10-stamp mill and concentrating plant at the mines.——The J. J. & S. S. mine (otherwise known as El Tigre), in the Tepic region, now has a shaft down 190 ft. on the vein, and when 10 ft. farther progress has been made drifts will be run in both directions. Samples taken from the present bottom of the shaft assay ₱66 per ton. This promising mine is owned by S. M. Waterman, J. D. Wedgwood, S. H. James, and Clare, conjointly.——The El Oro Mining & Railway Co. is sinking a new shaft on the slope of Somera Mtn., behind the assistant manager's house, to connect with the workings on the 1000-ft. level, now operated through the Somera shaft. Developments in the neighborhood of the San Patricio shaft have been favorable, and the general aspect of the property has prompted Frank Jenkins, the mine superintendent, to say that the old mine is still good for 15 years.——The Mexico mine of El Oro has closed down its mining operations for a month or six weeks while the shaft is being re-timbered; but the 40-stamp mill is kept running on low-grade ore from the dump. The value of the monthly output will be considerably reduced.

An American company with headquarters at Guadalajara has recently applied to the Mexican Government for a concession to construct a railway direct from Aguascalientes to Guadalajara, a distance of about 300 kilometres. The new company does not ask for subsidy from the Government, but that the road be exempted from taxes for a period of 80 years, and that no other railway be permitted to construct a parallel line. The name of the company is the Soledad Development Co., the general manager of which is David B. Russell.——Work is progressing satisfactorily in the Llanos de Oro Consolidated Mining Co.'s mines. This is a consolidation of the Reina de Oro Mining Co. at El Tiro, Sonora Quartz Mines Development Co. at La Yaqui, and the mill at Llanos de Oro. An aerial tramway is being built between the mine and the mill, which at present is running 10 stamps. Developments in the mine have been made to a depth of 700 ft., and for a distance of 1800 ft. along the vein.

W. H. Ellis, of New York City, has taken over extensive properties in the Taviche district, on which a ₱2,000,000 company is being organized for development purposes.——Expert geologists are now making examination of the new coalfields of the Tlaxiaco district. The work to date has established the extent and quality of the seams.——Kirby Thomas, of Mexico City, has made a sample shipment of Oaxaca mica to the United States. The quality of Oaxaca mica compares favorably with the North Carolina or Canada product.——A. M. Brooks has taken charge of the San José de Gracia mill of the Mexico Mines Development Co., in the Sierra Juarez camp.——Huntington Adams has taken charge of the properties of the Natividad mine, succeeding Porfirio Torres, who has been the managing director for some time. L. C. Howell is now in charge of the erection of the Natividad cyanide plant, vice W. B. Washington resigned.——The branch road to the Taviche district is being pushed to completion as rapidly as possible. Trains will be running over same inside of four months if the contractor's hopes are fully realized.——M. G. Dexter, operating the Atristain claims in the Taviche district, after several months of drifting, has cut a vein at great depth showing excellent ore, none of the samples from which have assayed less than $60.

Special Correspondence.

LONDON.

Kansanshi Copper. — Rhodesia-Katanga Railway. — Metallurgical Difficulties.—Crown Mines.—Oonah Mine, Tasmania. — Metallurgy of Complex Tin Ore.—Tasmanian Gold Mine.

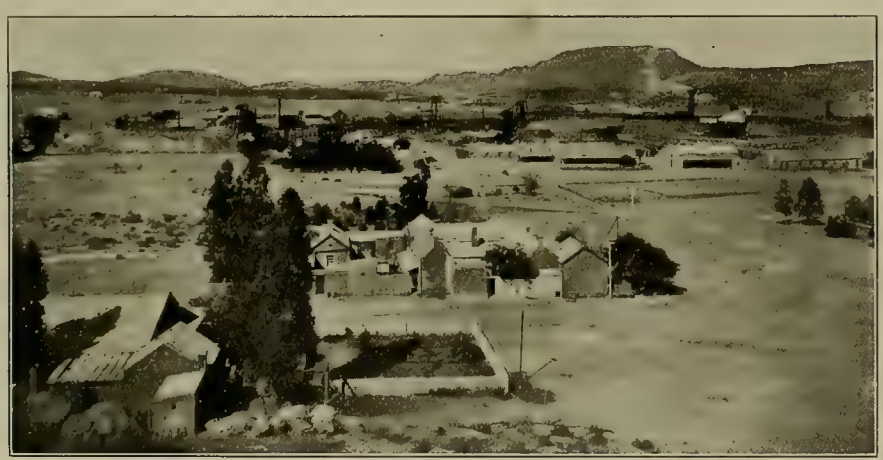
An important step toward the development of Central Africa has just been taken by the decision to proceed at once with the construction of an extension of the Rhodesian railways from Broken Hill to the Congo territory. For some time the owners of the extensive copper deposits in the country forming the watershed of the Congo and Zambesi rivers, situated in the northern part of Rhodesia and over the border in the Congo territory, have been engaged in planning such an extension. Robert Williams, chairman of the Tanganyika Concessions, Ltd., which owns the Kansanshi mines, has been for some time in negotiation with the Belgian company, the Union Minière du Haut Katanga, and with some of the companies that are subsidiaries to the British South Africa Co., with a view of making a financial arrangement by which the responsiblities and advantages could be equitably distributed among the various parties interested. The scheme is now settled, and a company called the Rhodesia Katanga Junction Railway & Mineral Co., Ltd., has been formed. The share capital is £1,510,000, and in addition £625,000 of debentures have been issued. The Tanganyika Concessions is entitled to about one-third of the share-capital, and the remainder is provided for exchange from debentures when so desired by the holders. The present issue of debentures is intended to provide the funds for the construction of the railway. Of this amount £178,000 will be subscribed by the Tanganyika Concessions, and £50,000 by the Rhodesia Copper Co., while £225,000 will be provided by the contractors, Pauling & Co. The Belgian company is also putting up money for the construction of part of the line on its side of the Rhodesia-Congo frontier. The three mines which will be served by this railway are the Star of the Congo, owned in Belgium, the Kansanshi, owned by the Tanganyika Concessions, and the M'Kubwa, owned by the Rhodesia Copper Co. As regards the Kansanshi mine, experiments are still being tried with a view of finding some process which will successfully treat the silicious oxidized copper ores of which the deposits chiefly consist. There are those who advise development in depth, seeking pyritic ores, before any extensive treatment-plant is decided on.

Some weeks ago I mentioned the amalgamation of a number of Rand properties under the name of the Crown Mines Limited, which was perhaps the most important of the consolidations now the order of the day in the Transvaal. This week a statement outlining the future policy and the prospects, prepared by G. E. Webber, has been issued, and some extracts from his report will be of interest. The consolidation involves four producers, the Crown Reef, Crown Deep, Langlaagte Deep, and the Robinson Central Deep, together with a large number of outlying properties only partly developed. To give an idea of the extent and nature of the four producing companies, it may be said that during the 12 months ended November 30 last, the total ore crushed was 1,533,855 tons, the average yield 8.44 dwt., or 35s. 5d. per ton, and the working cost 16s. 3d. per ton. The total net mining profit was £1,327,698. The ultimate life of the properties cannot be exactly gauged. It is, however, fairly well known that, over one-third of the area, the life at the present rate of extraction is something like 21 years. After the amalgamation is effected it is intended to supply additional tube-mills and a larger cyanide plant, and to increase the output to 1,800,000 tons. Eventually it is expected to increase it to 2,000,000 tons per year. At the latter rate the mines explored and unexplored will last 50 years. The estimate of the gold content is lower than the present extraction. The figures given are 7.1 dwt., or 29s. 10d. per ton, and with the economies to be effected the working costs are expected to be about 15s. 6d. per ton. These figures relate to the portion of the deposits to the north of a dike which appears to cause an upthrow. Though not causing any loss of vein, the presence of the dike makes it advisable to slightly alter the plans of development, and in the meantime hold over estimates of what may be found to the south. The consolidated company will have available cash assets of nearly three quarters of a million pounds, so that no further capital will be required for extension of plant and sinking of additional shafts. The issued nominal capital of the company will be only £931,506, in 1,863,012 shares of 10s. each, and Mr. Webber estimates that about £1,200,000 will be distributed yearly as dividends for an indefinite period. The forward quotations of the 10s. shares is about £7 10s., which means that the yield on the investment will be about 8% per annum. The company intends to inaugurate an amortization scheme, but, as it will be on the nominal capital and not on the market price, the individual shareholder will also have to provide another system for the redemption of his capital out of dividends. The formation of this company will make the largest gold mine on record, and will serve to indicate the immense possibilities of gold mining in the Transvaal.

The progress of operations at the Oonah mine in Tasmania is of great interest. This mine was acquired by the Mount Lyell Comstock Co. and floated in London as a separate company called the Oonah Mines, Ltd., a few months ago. The mine is well known, owing to the occurrence of argentiferous stannite in some of the veins. Stannite is a complex sulphide of iron, copper, and tin, an ore not often found. The mine is situated on the west side of Tasmania, about a mile and a half northwest of Zeehan. There are a number of mineral lodes, and at one time large quantities of valuable silver-lead ores were extracted. The lode containing stannite has not been worked until recently, owing partly to its variable character and partly to the fact that nobody cared to tackle the problem of smelting it on the spot. Close attention has recently been paid to the mine, and the method of treatment by Alexander Hill & Stewart, who have both personally studied the problem on the spot. A considerable amount of development has been done and ore-shoots have been opened in several places. At the present time it is estimated that 8650 tons of ore are ready for extraction, averaging 22 oz. silver, 5.57% copper, and 4.46% tin, and as much again may be put down as 'probable ore.' The question of treating this has been the subject of much experiment, for though the metallurgy of mixed tin and copper ores is perfectly well understood in Swansea and Cornwall, the prices offered by the smelters are not enough. In the old days in Cornwall when the copper pyrite and tin oxide occuring together could not be closely separated by the buddles, very little was paid for the middling, and the smelters made a handsome profit. The mixed ore and the stannite may be treated in much the same way, either by roasting and lixiviating, thus recovering the copper and silver from solution, leaving the tin in the residue, or by smelting. The Oonah company has shipped 300 tons to the United Alkali Co., and 200 tons to Swansea, where it is being experimented on at a small works by the company's metallurgist. The smelting results are of considerable interest, for the metallurgy is being developed by the company in order to reap the whole advantage of the metal-content. Mining companies have usually been content with smelting for copper and silver, and slagging away the tin, but the Oonah metallurgists are adapting the old Swansea method of obtaining two products in the furnace, one a copper-silver matte, and the other a metallic bottom consisting of an alloy of tin and copper. It is found possible by treating 30 tons of the ore, to produce 1¼ tons of matte containing 52% copper, and 80 oz. silver per ton, and 2 tons of argentiferous alloy, containing 58% copper and 36% tin. The matte contains 40% of the copper in the ore, and 16% and 1½% of the silver and tin respectively, and the alloy carries 44% of the copper and 75 of the silver and 84 of the tin contained in the ore. This copper-tin alloy does not bring a high price, for the smelters will give nothing for

the silver, and they make a charge of £8 to £17 per ton. The problem for the company to solve is how to make an alloy of suitable quality for use direct in producing gun-metal and other copper-tin alloys, a problem which at first sight usually seems attractive to the owners of mixed tin and copper ores.

The progress at the Tasmania Gold Mining Co., one of the John Taylor & Sons properties, is not so encouraging as had been hoped, owing to the falling off in the value of the ore, and the presence of barren rock and faults. This company was formed a few years ago to acquire a group of mines that had paid well, but which were no longer workable owing to the vast quantity of water to be handled. An adequate scheme was out of the question unless someone like John Taylor & Sons, with large financial resources, should come to the rescue. The pumping plant erected is one of the largest in the world, and is running without a hitch. The nature of the ore can be gauged by the yearly return for the period ended September 30, when 70,272 tons passed through the battery, yielding by amalgamation, chlorination, and cyanidation a total of 30,302 fine ounces. The total income was £129,118, and the total expenditure £110,927. Practically the whole of the balance has been written off for depreciation. The ore reserves are given as 59,125 tons ready for stoping, but at many points are other reserves of partly developed ore. Though the existing levels are giving low returns, the engineers and managers are confident that at the 1375-ft. level better results will be obtained.



Cape Copper Co.'s Mines at Ookiep, Namaqualand.

JOHANNESBURG, TRANSVAAL.

More Consolidations.—Stope-Drill Competition Entries. — Efficiency of Explosives in Stoping. — Utilizing Planes of Weakness. — Cape Copper Co.'s Report.—Lectures for Miners.— Gold Yield.

The matter of mine consolidations on the Rand has been mentioned in these notes frequently, but it has not been accorded too great attention. Consolidation is the keynote of present history on the field, and is likely to remain so throughout the year. Having seen the completion of the Crown Mines scheme, whereby four famous producers, and large blocks of virgin ground, have been welded into a concern which will certainly win profits exceeding £1,300,000 per annum, students of Rand mining now look for the next group of properties capable of amalgamation upon sound financial lines. That the Ferreira and Ferreira Deep will shortly be united is an open secret. Present results from these two renowned mines are as follows:

	Stamps.	Yield per month.	Profit per month.
Ferreira	120	£58,000	£36,000
Ferreira Deep	160	80,000	51,000

The former company has been the most prosperous on the Rand. Since its inception, it has paid out £3,016,750 in dividends, equivalent to 3465% on its capital. But amalgamation in the Central Rand is unlikely to cease here, and, according to report, a scheme is mooted for a consolidation in this area promising to surpass the Crown Mines, Ltd., in magnitude.

It is disappointing to find that only two American firms have entered machines for the forthcoming stope-drill test, out of 23 candidates. The American drills are the Murphy and Waugh. Without prejudice to the trials, which are to extend over many months, and will be influenced by nothing but the results of enduring efficiency under hard working-conditions, it may be mentioned that the Waugh has come to the front rapidly, and has been especially favored for back-stoping up to faults or dikes (where boys cannot be employed to the best advantage). Many of them have lately been introduced upon the French Rand mine, where peculiar difficulties of mining have been minimized by their use, and where both men and management have had cause to be satisfied with their drilling speed. On the average the Waugh puts in well over 20 ft. of hole per machine shift.

The practical services rendered to the industry by our technical societies have been well illustrated of late by the discussions held by the Chemical, Metallurgical & Mining Society upon problems of underground work. A few years ago this organization confined itself to questions relating to ore reduction and gold recovery, but the extension of its scope to mining has unquestionably stimulated the scientific investigation of many difficulties and experiences. It is remarkable that even today these open debates should be throwing light upon fundamental conditions of mining practice. Recently a paper was read upon 'The Theory of Blasting with High Explosives' by E. M. Weston. In the discussion, the theme has been elaborated widely, and two mine managers have given lengthy contributions dealing with the economical use of explosives in stoping and development, and pointing out the advisability of taking advantage of certain petrological features in the 'banket' too frequently neglected. This latter point is most fully discussed by H. M. Thomas, who urges that the primary consideration should be in the observation of any tendency of the conglomerates and country rock to break more easily in one direction than another. At first sight, this recommendation may appear rudimentary, but in reality it involves the application of greater intelligence than miners are apt to exercise. Bedding-planes are not referred to, for these are naturally utilized, by the most inexperienced, wherever they appear, and are commonly reflected in the good foot or hanging wall of underground workings. But attention is directed to the so-called 'fracture-planes' occasionally cutting vertically through the strata at right angles to the strike, the presence of which may be demonstrated by the

breaking of the ground in mining operations. The full significance of these lines of weakness—probably of appreciable importance only in certain places—has not been symmetrically determined. The inclination of the stope-face to the plane of the reef is planned in Rand mines according to the requirements for underhand, overhand, or breast-stoping, and to facilities for shoveling the broken rock to the boxes. But Mr. Thomas claims that the trend of these slight 'fracture-planes' should be a guiding factor. Clearly, if there is a regular sequence of such planes running through a stope, the duty of a given quantity of explosives is greatly increased by putting in the holes parallel to them, while, correspondingly, their neglect may be the cause of 'bull-ringing' (that is, the blasting out of the burden only at the bottom of the hole, with the collar left intact), or of breaking out only the top part of the burden. Upon the Jumpers Deep, of which Mr. Thomas is manager, the system of taking the utmost advantage of these fracture-planes is being put into practice on a scale promising to conclusively reveal its economic beenefits.

The comments of Stuart Martin, the mining engineer of Welsh colliery experience lately appointed consulting engineer to Wernher, Beit, Eckstein & Co., were interesting. After pointing out the unmistakable advantages of slips and cleavages in breaking coal in South Wales, he remarked that the first thing he did upon visiting Rand mines was to enquire which was the right direction of carrying the stope-face in order that rock might be broken skilfully. He gathered that, beyond the occurrence of occasional slips and the consideration of shoveling efficiency, the matter was held to be one of small account. He followed up this question of the line of weakness from one mine to another, and not until he reached the Jumpers Deep did he find it to be under serious investigation.

In common with all other copper producers, the Cape Copper Co. suffered severely during 1908, owing to the market collapse, and, having no appreciable amount of gold in its yield, it has been obliged to present a statement for the year even more strikingly unsatisfactory in comparison with previous returns than has been possible with many big producers in other countries. The profit realized reached a total of £144,366 for the financial year, against £379,910 in 1907. Of this decrease £191,902 is due to the reduced value of copper, but £24,153 of it must be attributed to the Tilt Cove, Newfoundland, workings. The output from Ookiep and Nababeep was 4356 tons—27 tons higher than the figure for the preceding year. Records of ore mined show that 13,927 tons, containing 15½% copper, were drawn from Ookiep and 59,348 tons, containing 4.90%, from the Nababeep North and South mines. It is reported that prospecting operations have been continued as vigorously as ever, but have still failed to disclose a new source of ore-supply to take the place of the nearly exhausted Ookiep. This wonderfully rich mine was discovered over 50 years ago, and has since turned out nearly 620,000 tons of ore, averaging 19½% copper. A general view of the camp is reproduced herewith, giving a good idea of the sterile character of this Namaqualand district, which has been so little beautified during a half-century of settlement, owing to the lack of a regular or beneficial rainfall.

Recognizing the utility of technical education among miners and the difficulty of attracting busy workers to the evening classes held at the college in Johannesburg, Prof. John Yates has just formed a scheme for the delivering of lectures at various centres along the Reef. The hope has been expressed that such a scheme might result in a marked diminution of our high accident-rate, but this anticipation is far too sanguine. It is, however, clearly unnecessary to seek revolutionary changes of efficiency as the probable outcome of the scheme to justify its experimental introduction. The opinions of numerous managers have been obtained on the question, with the result that the principle has been warmly commended, but past experience has shown that it is more necessary to provide opportunities attractive to the mine workers than merely to satisfy the academic ideals of the men in control. In spite of the fairly rigorous Government examinations, to be passed by mine foremen as well as by managers and surveyors, only a small percentage of the miners can be induced to trouble themselves in the quest of knowledge about such 'fancy notions' as the principles of blasting, ventilation, etc.

Owing to the inclusion of large amounts withdrawn from the gold reserve, the Transvaal's December output becomes a 'record' at £2,806,235. This brings the year's total to £29,957,610, or only £42,390 below the round sum of thirty millions sterling. New mills are destined to ensure a further substantial increase for the current year.

BISBEE, ARIZONA.

General Geology of Courtland District. — Development by Copper Queen and Calumet & Arizona.—Railroads Building.

Courtland, the new mining town of Cochise county, Arizona, is 36 miles northerly from Bisbee, 45 miles from Douglas, 10 miles from Pearce, and 5 miles from Gleason. The mineral ground occupies a spur of the Dragoon mountains and overlooks the White Sulphur Springs valley that stretches from Douglas to Willcox. The country comprises limestone, quartzite, and porphyry. The orebodies are mostly along a contact between limestone and quartzite, striking northwesterly, though there is one mine that appears to be mostly in porphyry, namely, the Great Western. It is considerably developed and was a shipper of ore as early as 1894. The Leadville claim was located 20 years ago, and has been slowly undergoing development since then and has shipped some ore. Recently the Calumet & Arizona Co. and the Copper Queen Con. M. Co. acquired property in the district, and the former, especially, has pushed development with vigor. The Germania shaft of the C. & A. has been sunk to a depth of 410 ft. on the orebody, development from it amounting to about 7000 ft. The ore has a dip of 23°, and was reached at 240 ft. from the surface. In the new Mary shaft of the Great Western the same orebody was struck at a higher level, 150 ft. below the surface. The April Fool shaft of the C. & A., 1000 ft. northwest of the Germania, which also belongs to the same company, has reached a depth of nearly 200 ft., and the expectation is to cut the same 'contact' later. The Copper Queen Co. is sinking the Silverton shaft 300 ft. east of the Great Western's Mary shaft, and has acquired and is developing the Casey group, lying west from the C. & A. holdings. The Casey shaft is down 250 ft., with levels in limestone from the 150 and 250-ft. stations. The ore is in a nearly vertical vein in lime, and is different from the great contact-deposit which may be penetrated at greater depth. The ore in the principal contact-vein, as is best illustrated by conditions in the Germania and the Mary, consists of copper carbonate, oxides, and chrysocolla, in a gangue of quartzite and altered lime. In the last two mines there are large bodies of pitch-colored, hydro-silicious material, locally termed 'black chrysocolla,' occurring altogether on the limestone side of the contact. It should be stated in this connection that the quartzite overlies the limestone, and the chrysocolla, being a secondary deposit, is found nearest the limestone foot-wall, with the oxides and carbonates above it. This vein, or contact deposit, is 80 to 150 ft. thick, the blanket of pay-ore being from 30 to 70 ft. thick; and it is authoritatively stated that this great body of ore assays from 7 to 8% copper. A big tonnage of ore of this grade now seems assured. The work on this vein follows the dip, which is 23°, a distance of 2100 ft., including work on the Germania and the Mary. The original Great Western group is about a mile south of the part known as the Mary mine. A new 288-ft. shaft has been sunk on the original group, and from it cross-cut levels are being driven into the ground below the old workings. This group has an orebody on the contact between limestone and porphyry, and has no direct connection with that opened by the C. & A. The Great Western belongs to Young Bros., of Clinton, Iowa, W. J. Young being the manager. The Leadville is managed by William Holmes, the original locator, who has

developed a strong vein of copper sulphide ore on a zone farther west than those just described, but having the same general strike. Here is a quartzite-porphyry contact, having but slight inclination from the vertical. The vein is opened by a 300-ft. shaft, from which extend 3000 ft. of lateral development, showing chalcopyrite ore from 5 to 8 ft. wide, said to assay 9% copper and to contain some gold. The Leadville is 3000 ft. west of the Germania and 130 ft. higher than the latter. The El Paso & Southwestern Railway Co. is preparing to build a branch line into Courtland from Douglas, over which these ores will be hauled to the Douglas smelters; and the Southern Pacific Co. is extending its Cochise-Pearce line toward Courtland, the plan being to continue it into Sonora. There are said to be 400 men employed at the Courtland mines, and the district contains 1500 people.

ALAMOS, MEXICO.

Railroad Facilities. — Alamos Silver-Copper Co.—Quintero Mine.—Zambona Development.—Pulpito Vein System.

Within the last year the Southern Pacific Co. has completed a branch railroad 60 miles long to Alamos, starting from Navajoa station, on the main line of the Cananea, Rio Yaqui & Pacific. This road affords transportation facilities for Alamos and Minas Nuevas, where exists one of the strongest contact-veins of southern Sonora. The district is famous in mining history, and the advent of the railroad is bringing about that strange commingling of the old and the new that is seen in so many places in Mexico. The great lode of silver and copper ore that attracted the Spaniards in 1720 has more recently attracted American and French investors, whose operations have been marked by a considerable degree of success. The mineralized zone, containing several parallel veins, is on a contact between granite and porphyry, the principal mines opened thereon being the Promontorio, Quintero, Zambona, Santo Domingo, and Pulpito. All these are close to Minas Nuevas, an ore-shipping station 10 miles from Alamos.

The Promontorio belongs to the Alamos Silver-Copper Co., of Philadelphia, and is managed by Jos. L. Overmuller. The main vein on this group stands vertical, and has a width of 20 to 40 ft. The ore carries an average of 35 oz. silver and 2½% copper, and contains a great deal of tetrahedrite accompanied by silver. The orebody is opened by an adit that gives a depth of 300 ft., and there are workings extending 300 ft. below the adit level. This company recently began operations and has been putting the mine in order. They have a dump containing 150,000 tons of milling ore, and have bought the equipment for a concentrating plant, which is soon to be erected. A smelting plant to produce copper matte is being considered.

The Quintero belongs to a company of French people. The mine has been developed to a depth of 1600 ft. on one of four veins embraced within the property. There is a concentrating plant and a single-track copper smelter, now temporarily closed. The property is managed by Carlos Mahaut. The Zambona Development Co. of Los Angeles operates the Zambona mine, A. J. Yaeger being the manager. The workings are 700 ft. deep, with extensive lateral development exposing an orebody of great width. The ores are those of silver and copper, characteristic of the district. The old concentrating mill has been in operation until recently, and a new mill, of 150 tons capacity, is being erected. The Santo Domingo occupies ground between the Quintero and the Zambona. It is controlled by the Sonora Central Mines Co., which owns 4000 ft. on the strike of the mineral zone. The principal shaft is 360 ft. deep, and from it there are three levels in ore. A winze is being sunk from the 300-ft. level at a point 1200 ft. from the main shaft. There is a steam hoist at the main shaft and an air-compressor and drills are to be installed. Plans for a concentrating mill are being drawn. The ore is composed of quartz and calcite, assaying 16 to 18 oz. silver per ton and 5 to 6% copper. Near the surface there is some lead, but this is not in evidence on the deeper levels. There are streaks of argentite and tetrahedrite that assay thousands of ounces of silver per ton and as high as 35% copper. J. R. Hendra is superintendent, E. A. Haggott of Los Angeles being consulting engineer.

The Pulpito ground covers an extension of the Quintero vein-system. It belongs to Antonio Goycoolea and sons, who formerly owned, but sold, the Zambona and Purísimo mines. They are driving a cross-cut level which will intersect the Pinta, Pulpito, and San Francisco veins of the system at 700 ft. The cross-cutting has progressed 1000 ft., 10 by 10 ft. in cross-section, and the intention is to drive over 3000 ft. and lay a double-track for ore cars. Ore taken from the Pinto vein where it is 2 ft. wide assayed 8½ kg. silver per ton and 41% copper. A 500-ft. drift was driven on the Pulpito vein, and from this drift a cross-cut was made to the San Francisco. Ore from the latter assayed 150 kg. silver and 22% copper. The silver is present as argentite, and the copper ore comprises both sulphide and carbonate. Manuel Goycoolea, who has the management of this and of other properties, states that mining on the Zambona, Quintero, and Promontorio began 200 years ago, and that members of the Goycoolea family have been mining at Alamos during the last 100 years. The little city of Alamos, founded in 1720, rests on the granite and porphyry hills through which the mineral zone strikes. T. P. Brenigar, in charge of the Nuevas-Promontorio group, owned by Kansas City people, has struck a vein of ore believed to be an extension of the Quintero and Zambona veins, this location being some distance south of those mines.

TORONTO, CANADA.

Dominion Iron & Steel v. Dominion Coal.—Notable Decision.—Gowganda Boom.—Cobalt Silver Queen.—Cobalt Development.

The decision of the Imperial Privy Council in Dominion Iron & Steel Co. *v.* Dominion Coal Co., appealed from the Supreme Court of Nova Scotia, caused excitement in financial circles. The combined capital invested in the two companies amounts to about $57,000,000. The steel and coal companies were closely associated from the outset, the former being organized by the same group of capitalists that controlled the coal company. For a time the steel company held a lease of the coal company. This terminated in 1903, and a contract for 90 years was entered into, by which the coal company was to furnish the coal required for the steel plant at Sydney, Nova Scotia, at $1.24 per ton, with an additional 4c. per ton for the use of cars. Friction arose over the unsuitability of coal furnished on account of its sulphur. In the fall of 1906 the supply fell short, and after a protracted controversy the coal company declared the contract at an end, alleging that the steel company had violated it by rejecting a quantity of the coal supplied. Thereupon the steel company brought suit for damages and obtained judgment in the Nova Scotia courts. An appeal to the Privy Council has resulted in sustaining this judgment and remitting the case to the Nova Scotia Supreme Court to assess the damages. As the contract embodied a description of the steel company's plant, the court ruled that this sufficiently indicated the purpose to which the coal was to be put, and placed an obligation on the coal company to supply suitable fuel. The damages will undoubtedly be heavy, the principal item being the difference between the contract price of $1.24, and the price which the steel company has subsequently been compelled to pay. The bill, as figured by the steel company, up to January 31, amounts to $3,901,663.

Interest continues to be centred on Gowganda. Many new ventures based on claims in this field are appealing to the public. As the snow is deep over most of the country, and real discovery impossible, prospectors are staking claims and filing affidavits on the chance of being able to 'make good' when the spring arrives. In the meantime, many of these wild-cat locations are bought by speculators without assurance that title can be perfected. The foundation is being laid for as fine a crop of swindles and lawsuits over title, as resulted from the Cobalt and Larder Lake

booms. Just now there is a rush to forward machinery and supplies into the camp before the winter breaks. The Gowganda mining division has been formed out of territory lately embraced within the limits of the Montreal river and Temagami forest reserve divisions. This gives a separate recording office to the new camp, and will considerably facilitate recording and inspection of claims. Harry Sheppard of Orillia is appointed recorder, with temporary headquarters at Smyth or Elk City, until an office can be provided at the Gowganda town-plot.

The slump in the stock of the Cobalt Silver Queen has been explained by the passing of the dividend. While the company, as previously stated, has ample funds on hand to pay a dividend, it was considered advisable to husband resources for development work. The Right of Way has been put on a 6% quarterly dividend basis. A 9% bonus has been declared for the current quarter. The value of the year's output was $218,000. Henry S. Hill and a syndicate of Buffalo capitalists have taken up an option on the Tallen claim, South Lorrain, where a shaft is down 50 ft. on the calcite vein. As many as 12 veins have been found in trenching. The Station Ground Mining Co. of Cobalt is negotiating with the Cobalt Lake Co. for an agreement by which they can use the workings of the Cobalt Lake to prospect their adjacent holdings. A strike was recently made at the Crown Reserve in the north cross-cut at the 100-ft. level, consisting of two veins about 3 in. wide and 15 in. apart. One assays 12,000 and the other over 2000 oz. silver per ton. At the La Rose, in driving on the McDonald vein, ore assaying 10,000 oz. silver per ton and 6 in. wide was struck. The shaft on No. 3 vein is being put down from 125 to 150 ft., the vein being 3 in. wide and yielding ore assaying 5000 oz. per ton. In the City of Cobalt rich ore has been found at the bottom of a winze from the main shaft 225 ft. from the surface. The vein is 9 in. wide, with slabs of native silver and argentite.

BUTTE, MONTANA.

Hearing in Smelter Smoke Case. — Elimination of Arsenic. — Butte-Montana Re-organization.—Tuolumne Mine.

The method for the elimination of arsenic from smelter smoke in use at the Washoe smelter at Anaconda does not prevent the escape of arsenic from the stack. While the company saves about two tons of pure arsenic daily, there escapes into the atmosphere an additional 10 tons of As_2O_3. At the Great Falls smelter of the Amalgamated Copper Co. a friction method for elimination of the arsenic is being installed in connection with the new high smelter-stack, and if it proves successful it will be substituted for the system now used at the Washoe, although the change will mean an expenditure of between $2,000,000 and $3,000,000. These were some of the interesting facts brought out at a supplementary hearing before Judge Hunt of the United States Court, conducted in an effort to find a means for further reducing the smoke nuisance. The company made many experiments with electricity as a method of removing the arsenic from the smoke. F. G. Cottrell, of Berkeley, Cal., who has an experimental plant of that character at Selby, Cal., was offered $200,000 by the Amalgamated Co. if he would perfect a method that would successfully remove the arsenic from the smoke, but he would not guarantee his method, saying that during the operation of his plant at Selby he had encountered mechanical difficulties of so serious a nature that he doubted if his system could be applied to the Washoe works. An effort was made to have him carry on his experiments at the Washoe and Great Falls smelters, but he preferred to experiment at Selby. President Roosevelt has instructed government experts to investigate the method of elimination used by the Tennessee Copper Co. at Ducktown with a view to compelling the Amalgamated to install the same system at the Washoe smelter, but F. J. Falding, a chemical engineer of New York, who evolved and constructed the system at Ducktown, testified before Judge Hunt in the Washoe hearing that the system was impracticable for the Washoe smelter. He declared that the problems at Anaconda were not at all like those at Ducktown, and the Washoe plant is at least six times as large as the plant at Ducktown. Mr. Falding is engaged in experiments at the Washoe, but he said that the method at present used at that smelter is the most complete and efficient of which he has any knowledge. It is the method used at other smelters where an attempt is made to eliminate arsenic, the method being by cooling and retarding the gases and disseminating them by means of a high stack. E. P. Mathewson, superintendent of the Washoe, said the company had spent hundreds of thousands of dollars in scouring the world for scientific information on the subject of smelter-smoke and the elimination of the poisonous substances. Every known method has been investigated, including all the cooling processes, spraying by water, by the admission of air, by radiation, by freezing; the bag-house process, electricity, friction, filtering the gases, decreasing the velocity of the gases, and by centrifugal gas cleaners. The spraying method can be used only at small plants where the volume of smoke is comparatively insignificant. At a plant like the Washoe the acid mud created by the spraying would be of so great a volume that it would be more dangerous than the smoke itself, as it would have to be allowed to pass into the streams. To install such a plant would cost $3,000,000, and not enough water would be available to operate it. The bag-house method is impracticable because the acids from the copper ore would destroy the bags. Such a plant would cost $2,750,000, with an operating cost of $1850 per day, while the arsenic recovered would be worth $204. Mr. Mathewson detailed the results of the company's investigations and tests of other methods and found them all unsuited. The present methods employed at the smelter were installed on the recommendation of Stuart Croasdale of Denver, endorsed by the company's consulting engineer, D. W. Brunton, after the latter had made a tour of Europe, where he studied the smelter question. The smelters using the process are one in Utah and another at Everett, Washington. The hearing before Judge Hunt will be taken up again on April 19 in Butte.

Of the ore received at the Washoe smelter 90%, or 9000 tons daily, is concentrating ore, and only 10% goes direct to the furnaces. As high as 2½% of arsenic has been found in the ore, and from that down to a trace. The largest percentage of arsenic is found when the ore contains enargite.

Another company that has taken the unpopular step of reorganization is the Butte-Montana Mining Co., owner of the Alex Scott and Annie mines, the former a well situated copper property, and the latter a silver mine of small value in the northern part of the Butte district. Some time ago some Duluth and Pittsburg men secured an option on a control of the company's stock, the company being capitalized at 1,000,000 shares of the par value of $1 per share. The new interests proposed to increase the capitalization and raise the par value to $10 per share. Opposition was manifested, and now comes the information that a new company, the Butte Alex Scott Co., has been organized with a capital stock of $1,250,000, divided into shares of $10 each. The purpose is to deliver to the Butte-Montana Co. 50,000 shares in payment or exchange for its property, in addition to which the debts of the old company will be paid. The Duluth people will take 50,000 shares at $2 each, paying into the treasury $100,000 at once, and will advance the remaining $400,000 whenever called for. It is understood that Butte-Montana stock may be exchanged for Butte Alex Scott stock at the rate of 20 shares for one share of the new.

The shaft of the Tuolumne mine has reached a depth of 1300 ft., and it is expected that cross-cutting at 1400 ft. can begin about April 1. On the 1000-ft. level the vein has been opened by drifts, but it does not contain good commercial ore, though the vein is large and strong, having a width of 26 ft., and it has been opened for 100 ft. in length. A station has been cut at 1200 ft. It is believed that on the 1400-ft. level the vein will be found rich. The company has just installed a new battery of boilers and a new compressor of 20-drill capacity.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

With the four weights of 1, 3, 9, and 27 lb., any unit number of pounds may be weighed between 1 and 40.

Brake horse-power is that which a motor can exert in doing outside work, and in the case of a steam-engine is less than the indicated horse-power by the power required in the engine to overcome the friction of its parts.

Slags containing much manganese retain silver. This is probably due to chemical action from the presence in the slag of the silicates of the sesquioxides ($xR_2O_3 \cdot ySiO_2$), and the formation of Mn_2O_3 occurs under such conditions. The reduction of this sesquioxide to protoxide would at the same time reduce other metals and render the bullion base.

Bronzes are notoriously difficult to cast, and it is a general practice to alloy 1 to 2% zinc in them for the purpose of getting better castings. It probably acts as a mild de-oxidiser. Zinc is often added to cheapen common bearings. Anything from 0 to 14% zinc, and from 8 to 18% tin is used, but those bearings high in zinc cannot be recommended for good work, as they wear badly.

Rock decomposition forms soil-grains in which the sizes bear certain definite relations to their chemical composition; for example, the lime-content decreases with the size of the particles, while the potash increases as the particles decrease in size. This, of course, applies to sediment which has been sorted by transporting waters. Phosphoric acid and magnesia are irregularly distributed, although there is a tendency to enrichment in those substances with increasing fineness of the particles. In untransported soil residues upon decomposing crystalline rocks the quantity of lime and potash are notably less than in the parent rock.

Sound from a moving source is heard by a person at a fixed spot different from its true note at every moment. As the source approaches, the length of the sound-waves is apparently decreased, and the length is similarly increased when the source is receding. Hence to a person at a station, the whistle of a passing train will sound higher than its true note while arriving, but lower when departing, and only correct when actually in front of the observer.

A Telford road was constructed by the United States Government during the administration of Andrew Jackson. It was built as a military highway, and was known as the National Turnpike, extending from Baltimore to St. Louis, approximately 1200 miles. It was one of the best examples of road-construction in the world. It was a true Telford road except in the prairie regions of Indiana and Illinois, where recourse was had to gravel. In some parts of the Allegheny mountains the lower courses have become so consolidated by natural cementation that they resemble conglomerates, and are often so firm that a fracture will extend across the rock-fragments.

Mining claims in Peru are based upon a unit of 2 hectares (1 hectare = 2.47 acres). Claims to which patent is obtained are held by as indefeasible a title as real estate, but the mine-title is distinct from the land-title. All unfenced land is open for prospecting and location of claims, whether owned privately or not, but permission to prospect must be obtained from the owner if the land be fenced. A license may be obtained from the proper authority to prospect fenced lands, but a deposit as a guarantee of indemnity for damages must be made. There is no discrimination against foreigners. The annual tax is 30 soles (about $24) on each claim.

Stoke-room competitive firing was inaugurated by the commander-in-chief on the cruise of the U. S. fleet around the world. The spirit of rivalry between the engineer-forces on the different vessels caused them to put forth their best efforts to reduce coal consumption. This has been effected to the gratifying extent of 20%. In a similar way efficiency has been improved in mining centres, notably in Western Australia, where for many years the production per man for each mine has been posted in the men's change houses; and the emulation among the miners brought about all the satisfactory results that could be desired.

Hydraulic horse-power may be one of two kinds. The first is the simpler, and is that due to position. It is equal to the product of the quantity of water available (in cu. ft. per sec.) multiplied by the weight of a cu. ft. of water (62.3) multiplied by the head in feet, divided by 550. The second is exemplified by power developed at the nozzle of a jet under pressure, and is equal to the quantity of water passing through the nozzle (in cu. ft. per sec.) multiplied by 62.3, multiplied by the square of the velocity of the jet, divided by 35420. The determination of this velocity cannot be expressed in quite simple terms, as it is dependent on lengths and diameters of pipe used, and on the internal friction.

The Panama Canal, if excavated to sea-level, would necessitate a cut approximately 365 ft. deep. The rock through which the cut would be made is decomposed, and disintegrates readily when exposed to atmospheric agencies. The slope necessary to give protection against destructive landslides under such circumstances would so enormously increase the cube of excavation as to make the cost prohibitive. The alternative method for a sea-level canal would be to excavate the sides in steps or terraces and face with concrete retaining-walls. This would be almost equally expensive. The objection to the lock-canal is, first, the doubt as to the stability of the foundations for the locks and dam, and second, the perpetual cost of operation, and loss of time in transit by ships.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Engineer as a Financier.

The Editor:

Sir—I have read with much interest, some sadness, and a great deal of curiosity the various letters that have appeared under this head. Interest, because the study of mankind is always interesting. Sadness, because it is somewhat saddening to see gentlemen who stand at the head of a great profession, and whose names are names to conjure with, trying to justify that, which in their inmost consciousness, they know cannot be justified. Curiosity, because I am curious to see how far they will succeed in deceiving themselves.

Much has been written, and yet the most that has been said is that there is no legal nor moral wrong, in a mining engineer taking a contingent fee, or reporting on a mine in which he is interested, "provided that he does not let his personal interest bias his judgment;" and this was said by the MINING AND SCIENTIFIC PRESS. But, Sir, is there not another view-point, outside the legal and moral one—the view-point of *honor*? There are certain things that are honorable, man may not do; and this practice is dangerously near the line, if not outside it altogether. There are many things that are quite innocent and harmless in themselves, that may not be permitted to men in certain positions. A judge may not try a case in which he is even slightly interested, although he may be quite capable of rendering a fair judgment.

Does the engineer owe nothing to the public, to his name, to his honor? I think he does, especially when he knows that his report will be used to induce the public to invest; and more especially when he knows that that report will be presented to the public as coming from a disinterested source. Suppose a client came to one of your eminent contributors and asked his advice about investing in a certain mining property, in which he—the mining engineer—was not interested, and showed him a flattering report on the mine signed by an equally eminent engineer as himself, whom he knew was interested in the mine in question. What advice would he give to his client? Something like this I fancy: "This mine has a good reputation, and this report is an excellent one, and the name signed to it should be a guarantee; but I suppose you are aware that he is heavily interested in this particular mine. If you are thinking of investing, it would be the part of wisdom to get a perfectly disinterested report." Would the client be quite so keen to invest on the strength of the report if he knew that it was open to the suspicion of bias? Is it right for a man to act as a judge in his own case? And a mining engineer passing on a mine is acting strictly as a judge.

One thing more; does not the very elaborate special pleading, shown in the letters of your correspondents, show that there is something that needs explaining; something that is not quite, er—quite, er—er—well, not quite nice, not quite in accordance with the highest ideals; that the doing of this thing is not quite clean, not quite to be reconciled to a high sense of honor. The question to be solved is not, Is it legal? Is it moral? but is it honorable. Money may be made by this practice, it is true, but does money compensate for a loss of honor? After all is money the only criterion of success? The mining engineer should, above all others, be "*sans peur et sans reproche*"?

CHAS. R. GENT.

Trimmer, California, January 30.

[In view of the quotation made by Mr. Gent, which places the MINING AND SCIENTIFIC PRESS in a position the exact opposite to that which it had assumed, we beg to quote from our editorial printed on July 18, 1908: "There is no moral wrong in an engineer holding an interest in a property which he has examined; there is not even any moral obligation which could require an honest man to decline contingent fees. * * * * * * Therefore it is not a case of pure ethics; but in deference to the prevailing adamic weakness, and to the need of so protecting the investing public that the mining engineer may, in furtherance of his ultimate pecuniary advantage, win confidence and have his services regularly esteemed and well remunerated, the matter assumes importance as a necessary part of a code of professional ethics. An engineer should not work for contingent fees. We know that because of the errors it continually leads to, and the unscrupulous class of promoter with whose operations the practice is perpetually associated. It is a custom that prevails in connection with those evils that walk in the darkness within the realm of mine-promotion." We endorse the spirit animating Mr. Gent's manly plea for an ethical standard for the mining engineer, but we may also ask how far mining engineering has yet put on professional consciousness in the recognition of what a profession really is?—EDITOR.]

The Engineer as a Financier.

The Editor:

Sir—On the question of professional ethics I would endorse your position rather than that of Mr. Hammond or Mr. Finlay. All that Mr. Hammond says about loyalty to the employer, the double capacity of an engineer as an employer, the expert witness, commissions on machinery, the statement that most of the swindling is done by laymen and not engineers, the duty to the investing public, and the engagement of local engineers as colleagues, is sound, and excellent; and his expert's Golden Rule is magnificent and worthy of being printed as an emblazoned maxim:

Tell unto others now whatsoever you would not have them tell on you (with unjust misunderstanding and scandalous comment) hereafter!

Commissions on sales and contingent fees seem to me to group themselves together as related to this

discussion. What Mr. Hammond and Mr. Finlay have said on these subjects, I regard as altogether untenable, unprofessional, and dangerous. Taking a commission from both seller and buyer is anomalous from the fact of making it a temptation to put the valuation as high as possible; and a flat fee from both parties is wrong if either is contingent; if not, it could be excused only by the frank understanding with each party that the other was also paying. Surely that must be a rare instance indeed; so rare as to make it farcical as a defense of professional laxity. Mr. Hammond proposes to justify accepting "compensation from the promoters, provided, first and without qualification, that full publicity be given to the nature of his connection with the enterprise." Now when this is done it virtually becomes a vendor's report, and would be practically so considered by any sensible buyer, and must be placed under that heading. Making the contingent fee dependent on the "subsequent success of the undertaking" seems utterly impracticable. How long are you to wait to prove the outcome? Questions of blame for failure and delay and of unforseen contingencies, etc., would be fruitful sources of misunderstanding and litigation.

Taking advantage of knowledge gained while under pay in one mine, to secure an ownership or lease in neighboring ground, without first imparting the full information to the employer, and giving him the refusal of the same opportunity, or holding an interest in a lease on the same property that pays the engineer a fee for consulting work, constitutes a species of commercial activity belonging to the same category as contingent compensation.

I would contend that no standing is high enough, no personal character strong enough, to justify a contingent compensation. To make personal character a guarantee for a questionable use of professional advantage is begging the question; it does not establish a rule or code to show how near the danger line some may go. Whoever heard of a judge, however high and honorable his standing, presuming to sit in a case in which he had a pecuniary interest, direct or indirect? Yet the circumstance would be no worse than that of an engineer taking a contingent fee. Doctors do frequently own interests in drug-stores; and the culpability of the situation is disclosed in the fact that they invariably keep such interests a secret from the general public.

But an engineer may well cast his fortune with an enterprise, as advocated by Mr. Hammond, as advisor or manager, provided that his compensation comes from the new owner and is in no way contingent upon the transfer of the property.

Mr. Finlay says that an engineer's "activities in the direction of speculation in stocks should be no more limited than those of any other man of common sense." This sentiment I regard, professionally, as most culpable. You, sir, say that "personal speculation in mining shares saps the foundation of professional integrity." I agree to this, but the thought does not apply so fully under this head as to a later paragraph. I think that a well defined line should be drawn between speculation in a venture on which one is professionally engaged and any other stock or mining transaction. This is a distinction which, so far, no one has made in this discussion. The limit is that professional engagement and pecuniary personal speculation shall not be tolerated together in connection with the same enterprise. The fact that, under this rule, an engineer loses his very best chances of speculation cannot excuse an infraction. I hold that an engineer has an unquestionable right to speculate in the stock of any concern on which he is not professionally employed, that he may even act as an absolute promoter, or make a sale on commission, as long as he informs the purchaser in regard to his connection with the enterprise, makes no report himself, and insists that the buyer shall employ a disinterested expert of his own choice; but whether it is good professional policy to do these things, I shall discuss later. The doctor may honorably own a drug-store in another town, where his prescriptions could not be sent. The stock-broker has the right to speculate in shares provided that, when he is buying or selling any particular stock for himself, he notifies any client who chances to apply for that particular stock, and advises him, in that particular instance, to go to another broker. This contingency is covered by Mr. Hammond's scheme of full publicity.

Granting an engineer's right to speculate in stocks, or to act as a promoter when not in connection with a professional engagement, there still remains the question of good professional policy and all of the really fine points of professional ethics.

If we are to follow the profession for life we must forego some of the "inalienable rights" of the financial engineer. It is a mistaken idea that the employer of professional service looks for one who is himself exhibiting great personal financial prosperity; my observation is that too keen an exhibition of the money-making quality rather begets distrust. The miner or the investing public is more sensitive to professional constancy than some seem to perceive. Under this head your sentiment, "participation in company finances undermines professional ethics and that personal speculation in mining shares saps the foundations of professional integrity," applies with full force.

Even when considered with reference to pecuniary income the question should be treated from the standpoint of a business that is to yield a revenue throughout an active life, and not as only a stepping-stone in finance. We do not have to reflect long to recall some engineer whose commercial activity readily betrayed the fact that he had taken hold of the profession as a vaulting pole to be quickly dropped when it had served its purpose. A good simile is found in mining operation: The financial engineer is the lessee who sinks a little shaft, without timbering, if possible, leaving rubbish in every drift, gouging out the first bunch of ore found, by underhand stoping, or any other way, until finally the ground is left to cave. The thoroughbred professional man represents the owner who puts down a well timbered shaft, of sufficient size and equipment, does his work in miner-like fashion, so that the

place may be worked as long as it will yield any profitable ore. Our commercial engineers at least lay themselves open to the suspicion of treating the profession after the manner of the lessee. In a discussion on the ethics of the situation, at least, I think that we should take the stand of the owner and ignore the lessee.

A vendor's report and relations to the public are two subjects covered by the same principles and should be treated under one head. A preliminary or vendor's report is, I think, an absolutely legitimate performance for an engineer for the reason that, when made in the proper form, its character as a seller's description of his property is apparent, and it frankly challenges verification by any other engineer who may be chosen by a purchaser. The engineer protects the public and himself at the same time. What you have said on this point well covers the subject. It is also illustrated by the well remembered Shakespearian proverb: "To thine own self be true, and it must follow, as the night the day, that thou canst not then be false to any man."

There is no part of this subject more worthy of consideration than that of demanding sufficient time to do justice to professional work. The young engineer in particular can study this subject with profit; but the question never vanishes throughout the longest professional career. The engineer is continually approached to make some report, or to act as an expert witness, without sufficient time for preparation. Sometimes from shrewd motives of economy, the employer comes with the statement that the work must be done by a certain date; sometimes the cunning promoter endeavors to cut the time short in order that the weak points may escape observation; but perhaps more often than otherwise, the employer, through pure ignorance of the time necessary, delays speaking to the engineer until the expiration of an option or the date of a court trial is too near at hand. The temptation is great; it is comparatively easy to stay the conscience with the thought that an engineer cannot report on more than he is able to see, nor be held responsible beyond the points covered. Nevertheless right here lies the greatest danger and many pitfalls. If he cannot do justice to the case he cannot do justice to himself. He must decline employment to stand by his colors. I can think of no branch of the subject in which professional ethics comes closer to every day practical application.

V. G. Hills.

Denver, February 6.

Power in Stamp-Milling.

The Editor:

Sir—In your issue of February 6, I notice an article by H. Haas referring to my article, 'Stamp-Mill Practice on the Mother Lode.' Mr. Haas questions the correctness of my statement regarding the horsepower used in operating our new 20-stamp mill; he states authoritatively that 42½ hp. is required to operate twenty 1000-lb. stamps, dropping 106 times per minute with a drop of 7 in.; with an additional 10 hp. to operate the 12 Frue vanners; making 52½ hp. to operate the entire 20-stamp mill. After an experience of over ten years in mill-practice on the Mother Lode, I am compelled to differ with Mr. Haas and his authorities. The actual power required to operate the 20 stamps in question together with the twelve 4-ft. Frue vanners is 42½ hp. It requires only ½ hp. to operate one 4-ft. Frue vanner, provided the machine is kept in good running order, while if that care is neglected, it would undoubtedly require more power.

Regarding the comparison between the old and new mill, as suggested by Mr. Haas, I may say that in the latter the mortars are 6 in. shorter and 3 in. narrower, which necessitates the stamps being closer together and less room for the ore to get from under the stamps. I find it a great disadvantage to the crushing capacity of the mill to have the ore brought to the mill very fine, for when the ore is fairly coarse the stamps have something hard to drop upon and the ore is pulverized much faster. This is something on the principle of the Gates rock-breaker; when the ore comes up from the mine as coarse as the jaws will take it, the capacity is much greater than when it is fed with fine ore.

Alex Chalmers.

Angels Camp, California, February 11.

Finger-Chute.

The Editor:

Sir—In your issue of October 17, 1908, appeared an article by Mr. T. A. Rickard, describing the finger-chute of the Alaska Treadwell mine.

Some years ago I saw the description of this gate by Mr. Kinzie and used the idea in the Liberty Bell mine at Telluride, Colorado. The excellent results secured under hard conditions seem to warrant a description of the gate as modified.

The Liberty Bell ore comes from the mine at a level 50 ft. above the floor of the loading-station of the aerial tramway. Dumped from the cars, it passes over grizzlies, the coarse and fine falling into separate bins. The coarse ore has a maximum drop of 30 ft. into the bottom of the bin when empty. The frame of the bin is of 12-in. square timbers, 5 ft. apart across the front. As originally constructed, the movement of all ore, coarse and fine alike, was controlled by ordinary stopper-boards reinforced with iron and held in slots in a subordinate frame-work between the main front posts. At no time was there difficulty with the fine ore, but the trouble in moving the coarse ore was continuous. With little ore in the bin, there was hard wear and breakage of boards and subordinate frame-work. As the ore accumulated, it arched between the floor and the above frame-work, requiring the effort of two men to supply 20 tons hourly to the tramway.

The finger-gate offered advantages even though it seemed to have been used against a constant pressure rather than to absorb the shock of flying ore. This condition seemed to demand weight in the fingers. The necessity for doing away with the tendency to arch seemed adequately provided by the length of finger given. Therefore we built our first

fingers as shown in the accompanying drawing: 12 in. square verticals, 8 in. square horizontals, and 6 by 8-in. braces. The verticals were faced with 30-lb. rail. The weights shown proved unnecessary. The equipment for raising the gate was the same as has been described.

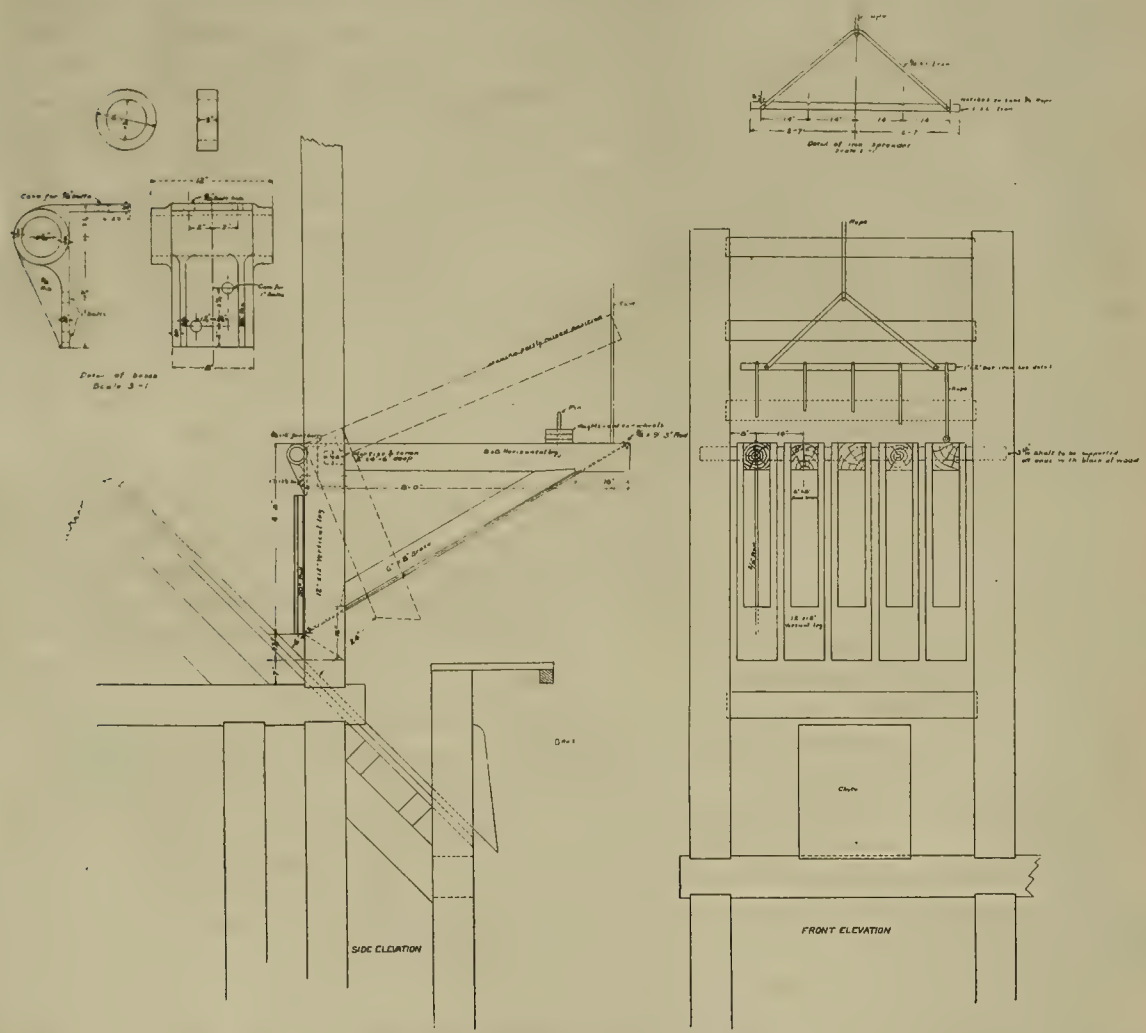
The operation of the gate has been satisfactory, the repair costs have been low, and one man less per shift has been required. The gate is raised, the ore runs freely into our so-called fore-bay, in which it lies without pressure, and from there through the simple hand-operated flap-gate into the one-third ton tramway-buckets.

So satisfactory has the gate been that it has been installed above the crushers in a new ore-house and underground in a large pocket. At these points it is likely that single-acting air-cylinders will be used to raise the fingers in order to expedite the movement of ore.

At the Mogul mill at Pluma, South Dakota, the dimensions used at the Alaska Treadwell have been followed in a gate placed above the crusher. The bin above is comparatively shallow. It seems that at this plant the fingers have separate ropes and the crusherman maintains a steady feed by pulling one or two ropes at a time. The rope-ends come down to convenient distance and no windlass is used. Both there and at the Liberty Bell the ore is wet at times and somewhat sticky.

In many places a simpler gate will serve, but for coarse ore when there is danger of arching and shock must be absorbed, the finger-gate has merit. Between the light finger, as built at the Alaska Treadwell, and the heavy one used at the Liberty Bell there is a wide range, in which something can be found to meet any ordinary demand.

Denver, February 4. CHARLES A. CHASE.



Finger-Chute Used in Liberty Bell Mine, Colorado.

The height to which a jet of water may be thrown in a vertical direction depends on several factors. The nozzle should be long and only slightly conically convergent. A greater height will be obtained with a large jet than with a smaller; thus, for instance, under a head of 300 ft. with a 6-in. jet, an elevation of 270 ft. may be reached, while with a 2- and a 1-in. jet, only 210 and 150 ft. respectively would be attained. In order to diminish resistance from the descending water a jet must be directed with a slight inclination from the vertical.

THE VACUUM-PUMP IN THE CYANIDING OF SAND.

By W. A. Caldecott.

*The use of the vacuum-pump in cyanidation is as old as the first introduction of the cyanide process in this district by J. S. MacArthur in 1890,† but of late years the method of vacuum-filtration generally has had far more attention paid to it than at any previous period. Various old sand-plants on the Rand were fitted with small vacuum-pumps connected with the leaching-vats, but this practice for some time past has not been general. At the joint Simmer Deep-Jupiter plant, which has ten 50-ft. sand-leaching vats, a large vacuum-pump with a capacity of 420 cu. ft. air per min. was installed, but being somewhat large has since been replaced by one of a quarter the size. The results proved so satisfactory that the practice will now be adopted at other plants, as the cost of installation and of power for operation is small. In installing a vacuum air-pump, it is connected with the upper portion of a receiver, while a plunger-pump for the solution is connected with the lower portion of the same vessel, or if the nature of the ground permit of it, a pipe from the bottom of the receiver may be carried down to dip below the solution-level in a small vat placed about 30 ft. lower. In the latter case solution entering the lower sump by the pipe from the receiver is re-elevated to the boxes by a centrifugal or other pump. No brass fittings should be employed in any of the above pumps.

Each leaching-pipe from the sand-vats is connected with the receiver by a short by-pass pipe fitted with a valve, but when leaching is proceeding freely, as in the earlier stages when the surface of the sand-charge is still covered with solution, the vacuum-pump is not used, and the full flow of solution under the action of gravity proceeds direct to the boxes. When, however, the rate of leaching falls off, the connection to the receiver is opened, and the air and solution-pumps are started. The former maintains a vacuum of say 10 in. of mercury, while the latter removes solution continuously from the receiver and delivers it to the boxes. This operation is continued for an hour or two after the charge is drained, so as to draw down air into all the interstitial spaces in a way which, owing to capillary attraction, is practically impossible in the usually limited time available for sand-treatment with leaching by gravity only. Such thorough draining and aeration is carried out three or four times during the treatment of a charge of sand, and with especial thoroughness prior to the discharge of the residue. By employing two receivers, strong as well as weak solution can be drained off simultaneously. Sand ready for discharge, and apparently drained thoroughly by gravitation-leaching, will on application of the vacuum-pump yield a strong flow of solution amounting to several tons per charge, of which the gold content would otherwise have gone to the residue-dump.

The advantages derived from the foregoing practice are fairly apparent, but may be specified as follows: (a) The time required for the passage of a wash through the charge is much reduced; (b) owing to the small percentage of moisture, say 9%, left in the sand after each draining and aeration with the vacuum-pump, very little gold-bearing solution is left to mix with and raise the value of the next wash, so that the leachings are soon reduced to a minimum value, and a less volume of wash-solution effects a more thorough removal of dissolved gold than by the present usual practice; (c) the amount of moisture discharged with the residue is much reduced, and (d) the aeration obtainable during treatment accelerates the dissolving of the gold by supplying oxygen to the solvent.

Besides its use in the leaching-vats proper, a vacuum-pump is of obvious assistance in the speedy removal of water from a collected sand-charge, or of solution where sand is settled from a sand-solution pulp, so that the charge is the sooner ready for transfer, and the collecting capacity of a given number of vats is increased. In the use of the vacuum-pump in former times already referred to, the main object was to assist in the leaching of slimy and slow-leaching charges, but under these conditions the solution tended to travel in the path of least resistance, and the practical abandonment of the practice was probably due to the slight benefit afforded by small vacuum-pumps under such circumstances. At the present time, uniform freely leachable charges, free from slime in the interstitial spaces between the sand grains, yield the best results from the application of the vacuum-pump.

*Read before Chem., Met. & Min. Soc. of South Africa, from advance copy, by courtesy of the author.

†*Journal* of C. M. & M. Soc. of S. A., December, 1908.

In the Miami copper mine, near Globe, Arizona, the ore in the upper workings of the property averaged about 3%. At the 400-ft. level the average was 2¾%, and at the 570-ft. level, the lowest in the mine, in the first drift from the shaft, the average was about 2½%. This steady decline in the copper content of the ore led to the belief that the bottom of the orebody was approaching, although all ores carrying 2% copper are workable. As the 570-ft. level development work progressed, however, the drifts have again run into high-grade ore. This would indicate that the fears of the Miami orebody pinching out were not well based, and that the tonnage of high-grade ore in the mine will be greater than heretofore assumed.

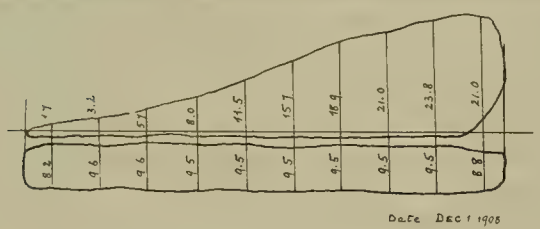
Manganiferous silver ores occur at Leadville, Colorado, in large deposits at or near the contact of porphyry and blue limestone, replacing the latter. These deposits consist of a black mixture of manganese and iron oxides with lead carbonate and silver. The manganese content varies from 10 to 40%. Manganese and iron oxides are associated only with the oxidized portions of the Leadville deposits. In the lower unoxidized portions the minerals are mainly pyrite, marcasite, sphalerite, and galena. Manganese minerals are conspicuously absent, and it is believed that the large quantity of manganese oxide in the unoxidized ore is due to infiltration from the porphyry.

CORNISH PUMPS AND PUMPING ENGINES.—II.

Written for the MINING AND SCIENTIFIC PRESS
By HENRY F. COLLINS.

The great advantage of the Cornish engine as compared with other types used for operating Cornish pumps is its simplicity and the small number of wearing parts. Reference has already been made to the long active life of many pumping-engines still at work, and it may be stated with confidence that no other type of engine can show such a record; this is due primarily to simplicity of design. The first cost of a Cornish engine is doubtless higher than that of a compound horizontal engine to do the same work, but against this we may offset: the annual cost of maintenance; double pitwork with balanced rods; extra cost of the quadrants for the horizontal engine, this last item being an offset against the cost of the beam for the Cornish engine.

When, however, the quantity of water to be raised through one shaft is greater than the capacity of one set of 24 in. pitwork, so that two sets have to be installed in the one shaft, the horizontal engine seems to be distinctly indicated. A case in point is the Tasmania mine, at Beaconsfield, Tasmania, where the new plant (which is capable of raising from a depth of 1000 ft. no less than 8,000,000 imperial gallons or 40,000 short tons of water per 24 hours) comprises three separate units, each of which consists of a compound horizontal engine with cylinders, 54 and 108 in. diam. by 10 ft. stroke, to which is attached by means of quadrants a pair of balanced rods tapering from 22 in. down to 18 in. sq., each working plungers of 20 in. diam., with steel rising mains that are, however, only 16 in. diameter.



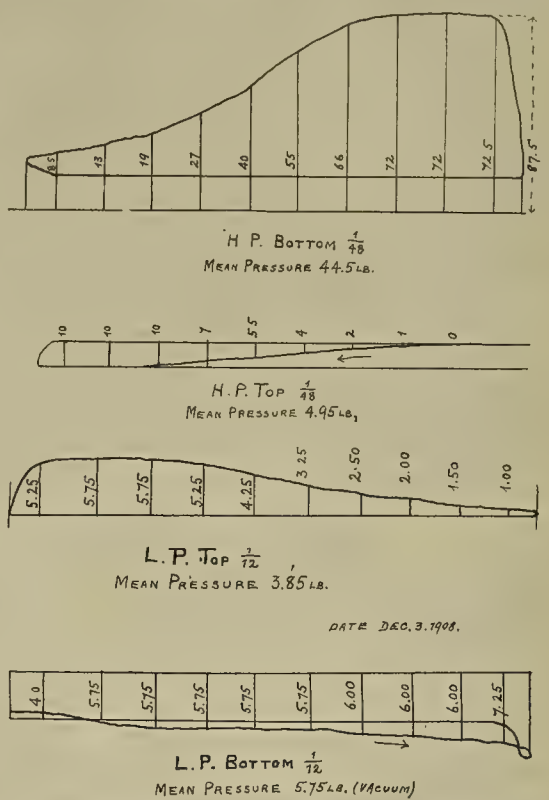
Indicator Cards From Cornish Pumping Engine.

Working 4⅓ strokes per min.; cylinder 90 in. diam.; cylinder-stroke 10 ft., pump-stroke 9 ft.; boiler-pressure 41 lb.; vacuum 8 to 10 lb.; cut-off ⅜; mean pressure 22.31 lb.

As to the comparative economy of the compound-horizontal and Cornish types of engine no exact figures are available but it seems certain that the full economy theoretically obtainable from the use of steam at 150 to 160 lb. pressure can never be realized in practice on account of the fact that the initial velocity of the piston corresponding to so high an initial pressure would throw too heavy a strain upon the rods and quadrants.

Many attempts have been made at different times to compound the Cornish single-acting engine and thus secure the additional economy realizable from the expansion of steam from higher initial pressures. The first of these attempts was by Woolf in 1814 and a later and more notable one was that of Sims in 1840, the engine erected by this engineer at the Carn Brea mine in that year having a high-pressure cylinder 60 in. and a low-pressure cylinder 90 in. diam. Neither of these compound engines, however, did as well as the best of the simple engines working at the same time. A more recent attempt of the same kind is that of Davey, whose inverted compound single-acting engine with his valuable differential cataract gear has been erected in one or two places. Again, however, the greater economy seems to be as elusive as ever, the advantages of expanding steam from an initial boiler-pressure of 150 lb. are obvious, in theory, but in practice they seem to prove unattainable.

The accompanying two sets of diagrams taken respectively off a 90 in. Cornish engine about 40 years old and an inverted compound single-acting engine



Indicator Cards From Compound Cornish Pumping Engine.

Working 3¼ strokes per min.; high-pressure cylinder 54 in. diam., 8-ft. stroke; low-pressure cylinder 94 in. diam., 10-ft. stroke; boiler-pressure 155 lb.; vacuum 17 to 22 lb.; cut-off ⅜.

The accompanying two sets of diagrams taken respectively off a 90 in. Cornish engine about 40 years old and an inverted compound single-acting engine about 5 years old will illustrate the point. The plain Cornish engine is at the present time raising water from the 300 fathom or 1800 ft. level in the Wheal Agar vertical shaft of the East Pool mine by means of 8 plunger-lifts 16 to 16¼ in. diam. with a short 15 in. bucket-lift at bottom. The water load in the shaft is 142,196 lb., equivalent to 20.11 lb. per sq. in. on the piston, while the stroke of the rod is 9 ft. Neglecting friction and slip, therefore, the theoretical water hp. at 4⅓ strokes per min. would be 168.04, whereas the indicated horse-power is 186.372, the 'efficiency' shown being thus 90.16%. The consumption of coal being about 5 tons per 24 hr. the calculated 'duty' or number of foot-pounds supposed to be done in raising water per 112 lb. of coal used, neglecting slip and friction, is about 79 millions. Coal is never

weighed into boilers at Cornish mines, so that the fuel consumption is never known exactly except as an average over a considerable period of time, still the above figure is pretty close to the truth. As to the actual water horse-power no figures are available because the water raised is never measured; this would be the only means of determining with accuracy the slip. Still it may be reckoned that 20% is an ample allowance for slip and friction together, and in any case the calculated duty will serve as a fair basis for comparing the work done by different types of engine.

Turning now to the diagrams of the compound single-acting engine, it may be remarked that this engine is by the firm of Hathorn, Davey & Co. and is working at the mine in Spain already mentioned. It operates a fine set of pitwork put in during the past few years with an 18 in. plunger at 557 ft. from surface or 590 ft. below the level of the discharge from the 16 in. rising main; the second plunger at 951 ft. from surface, or 394 ft. below the first, is 18¼ in. diam.; a third temporary plunger of the same diameter is at 1150 ft. from surface or 200 ft. lower, while below this again is an 18½ in. bucket-lift. When the diagrams were taken the latter was unhitched, at which time the total theoretical water-load per stroke in the shaft was 1,301,068 ft. lb. which at 3¼ strokes per min. (the dry-season rate) is equivalent to 128.14 calculated water horse-power. The indicated horse-power developed by the engine on the active or 'indoor' stroke is calculated thus:

	Mean pressure of steam.	Area of piston (sq. in.) × stroke (ft.) ÷ 33,000.	I. H. P.
High-pressure bottom....	44.50	0.540	78.10
High-pressure top	4.95	0.555	8.88
Low-pressure top	3.85	2.103	24.95
Low-pressure bottom	5.75	2.087	38.82
			150.75

The efficiency, that is $\frac{\text{I. H. P.}}{\text{calculated water hp.}}$, is in this case, therefore, only 85.6% as compared with 90.16% in the Cornish simple engine quoted. The lower efficiency seems at first sight inexplicable yet some light can be thrown upon it, as will be seen later. The consumption of coal in this engine has been several times determined by careful tests lasting a week each, the evaporative power of the coal has been also ascertained at the same time by careful measurement of the feed-water used. Careful consideration of the prices of the various kinds of fuel obtainable locally, after many experiments, has dictated the use of a mixture of two parts of steam coal with one part of anthracite slack, the latter being so very much cheaper as to more than offset its inferior quality. The net realized evaporative power of the mixture averages 7.79 lb. and calculation of the volume of the steam entering the cylinder before the cut-off operates, checks fairly with the actual weighed consumption of coal, which at this comparatively slow speed works out at 2.296 lb. per stroke or 2.97 lb. per I. H. P. per hr., equivalent to just under 2½ lb. per I. H. P. hr., using coal having a realizable evaporative power of 9, or 2.97 lb. per I. H. P. hr. with coal having a realizable evaporative power of about 8.5. The calculated duty therefore, neglecting slip and friction is about 63,500,000 ft. lb. per 112 lb. coal burned—equivalent to about 69,500,000 if the coal burned had, like that consumed by the Cornish engine, a net evaporative power of about 8.5.

We are therefore brought face to face with the remarkable fact that whereas an old single-acting and single-expansion Cornish engine using steam at 41 lb. pressure shows a calculated duty of 79 millions, a quite new compound single-acting engine, doing similar work under similar conditions but using steam at 155 lb. pressure, shows a duty of 69½ millions when using a similar quality of coal. The result would be startling if we were not aware of previous failures of slow-moving compound engines to realize in practice the expected economies. No complete explanation can be afforded of the comparatively poor economic results shown by this particular compound engine, but the following considerations may throw some light upon it: (1) The initial pressure in the high-pressure cylinder with the stop-valve wide open is seen from the diagram to be only 87½ lb., whereas the boiler-pressure was 155 lb. and the pressure in the steam-pipe just behind the stop-valve was from 145 to 150 lb. during admission. This proves either that an enormous amount of condensation was taking place in the high-pressure cylinder or else, as is more probable, there was a large amount of 'wire-drawing' through the admission-valve and passages. The cylinder being jacketed and not very hot to the touch it is probable that the falling off in initial pressure in the cylinder as compared with the pressure in the steam-pipes is due chiefly to wire-drawing through the stop and admission-valves and passages. (2) The lower efficiency, that is, $\frac{\text{I. H. P.}}{\text{calculated water horse-power}}$, of the compound engine as compared with the simple Cornish engine, namely, 90.16% as against 85.6%, is probably due to the fact that the radiation losses in an engine making only 3 to 5 double strokes per minute are of much greater moment than in ordinary swiftly moving compound engines. Under these exceptional conditions of slow motion with long periods of rest, the total radiation from the two cylinders and the long steam-pipe reservoir between them forms an appreciable fraction of the total heat; expansion by stages under these conditions becomes actually less effective than direct expansion to the limit in a single cylinder. (3) Even if the valves and passages were enlarged so that the initial pressure inside the high-pressure cylinder could be raised to something approaching the boiler-pressure, say 120 to 130 lb. per sq. in., cutting off earlier in the stroke, it seems probable that the shock to the pitwork from the consequently much higher initial velocity of the piston would be so great that from motives of prudence the stop-valve would have to be kept partly closed, with the result that the steam would be wire-drawn to exactly the same extent as now obtains, with the restricted passages of the present admission-valves.

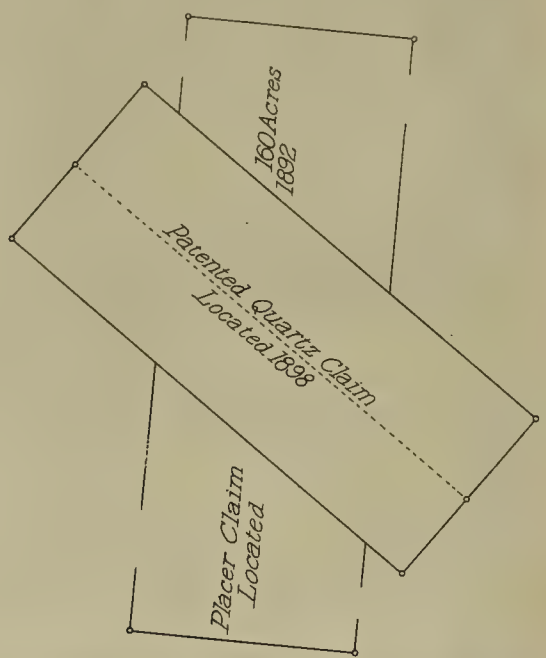
Although, at present, I am unable to cite similar exact details of practice with compound horizontal

engines operating Cornish pitwork, such information as is available to me indicates that the same difficulties have been experienced and that they fail in practice to realize the economies in fuel consumption theoretically attainable, in exactly the same manner as the vertical compound engine cited has failed to realize those economies. The other advantages offered by horizontal engines, namely, compactness and low cost of engine-foundations and house for a given pumping capacity, still subsist, and for a very large quantity to be raised from a single shaft (anything more than 1,500,000 to 1,700,000 gal. per 24 hr., which is the limit for a single set of pitwork, as stated at the beginning of this article) there can be no doubt that the horizontal engine with balanced double pitwork is not only the cheapest, but the most convenient in working. If on the other hand the quantity of water to be handled is within the capacity of a single set of 18 or 20 in. pitwork, no type of engine will give more reliable service, or work with greater economy than a plain well-built single-acting Cornish engine using dry steam at a boiler-pressure of about 45 to 50 lb. and maintaining a good vacuum. For intermediate conditions, that is, for quantities of between 1,200,000 and 1,700,000 imperial gallons per 24 hours, the choice as between a Cornish engine with single 24-in. pitwork and a horizontal engine with double 18 or 20 in. work is one that should be decided by circumstances, such as the probability or otherwise of an increase in the water, and by local conditions such as facility of transport, of obtaining good building stone, etc. For what may be called frontier conditions, such as prevail in the newer and less accessible mining camps of the Western States and Mexico, both Cornish pitwork and the engines required for working it are alike unsuitable solely on account of the great weight of the installation, which would render both transport and erection excessively costly. But in the Eastern States and even in the older and more settled mining camps of the Western States, such as Butte and Leadville, it may be doubted whether sufficient attention has been given to the advantages of the Cornish system of pumping, which are certainly worthy of more careful consideration than they have hitherto received at the hands of American mining engineers.

Dust clouds are not infrequently blown over the Mediterranean from the sandy plains and dessicated pools of north Africa. When in moderate quantity this southern wind is known in southern France as the 'Sirocco'. Often, however, the quantity is enormous. In the middle of the 18th century an area of north Italy, estimated at about 1800 square miles, was covered with a layer of dust which in some places reached the depth of 1 inch. In 1846 the Sahara dust reached Lyons, and it is said to have since been detected as far as Boulogne, in the north of France. A most remarkable example occurred in March 1901, when a vast amount of dust was carried from the desert south of Algeria across Europe into Russia. It is estimated that not less than 1,800,000 tons of fine sand and dust were then transported, two thirds of which fell south of the Alps.

CONFLICT OF PLACER WITH QUARTZ CLAIM.

A placer claim was located in 1892, and in 1898 a quartz location was made by other parties, the boundaries of which conflicted with those of the placer claim. The quartz locator applied for and obtained a patent for his claim in 1905, which application and patent included the area in conflict with the placer. The placer claimant failed to adverse the quartz patent application. Since issuance of the patent, it has been determined that the pay-channel of the placer crosses underneath the surface and passes through the vertical boundaries of the quartz claim. The enquiry is, has the placer claimant the right to follow



the channel underneath the patented quartz claim? The answer is obvious. He has no such right. Having failed to adverse the application for quartz patent, the placer claimant waived whatever rights he might have had by virtue of priority of location. The quartz patentee is conclusively presumed to own the entire surface and everything within the vertical boundary planes of his patented claim, except as against one having the apex of a lode in a location outside of the patented quartz claim boundaries, such outside apex locator having the right, under certain conditions, to follow his vein on its downward course underneath the patented surface. No such right is given to the owner of a placer claim to follow his pay-channel underneath patented claims. The fact that the quartz mine can not be profitably operated is not an element to be considered. Such fact subtracts nothing from the rights conveyed by the patent and adds nothing to the rights of the placer claimant.

Rhodochrosite is principally found in ore-bearing veins, and although more commonly found in silver veins, it is also present in gold veins, being particularly abundant in the Telluride district, Colorado. It usually occurs in brilliant pink bands running longitudinally in the vein.

CONCRETE IN MINE SUPPORT.

Written for the MINING AND SCIENTIFIC PRESS
By W. R. CRANE.

With the constantly increasing difficulty experienced in securing sufficient quantities of the proper kinds of timber for use in mines, and with prospect of still greater scarcity, a demand has come for a suitable substitute for timber in mines. Concrete seems to be best suited, owing to its adaptability. At present concrete is receiving extended application, and owing to many successful substitutions for timber under severe conditions, it is growing in favor.

Other materials used in place of timber in mines are stone and brick, but these have not met with favor in American practice, primarily because of the high cost of transportation and also perviousness. Concrete enjoys the advantage over stone and brick in that it can be more readily placed; as fewer skilled laborers are required, the first cost is likely to be considerably less, but it takes about three times longer to place concrete than to set timbers, and from actual experience it has been shown that concrete exceeds timber in first cost from 25 to 45%, the variation depending largely upon the shape of the construction. When once constructed, however, a concrete lining is practically indestructible, and few or no repairs are ever necessary, hence no delays, with consequent loss of output and extra expense of maintenance result.

Another important factor is the great strength of concrete as compared with timber; this is especially true of shaft-lining. Concrete is now widely employed in lining shafts and mine galleries, tunnels, gangways, in the support of rooms and stations, in building dams and stoppings underground, and so forth.

It has been found that the shape of a shaft-lining is not of as much importance, from the standpoint of support, as was formerly thought. Circular and elliptical forms are necessary when stone and brick are used, and are obviously to be preferred when concrete blocks are employed. Several rectangular concrete shaft-linings have been successfully constructed in the United States, but practice favors oval and elliptical forms. Strength and cheapness are the principal reasons for the choice of circular and elliptical forms; but these are not economical of space. However, only about half the thickness of lining is necessary when curvilinear forms are employed; therefore the size of the excavation is actually reduced, and the cost of the concrete lining is practically halved.

In tunnel-work two or more lines of track necessitate an arched roof, while with one line of track, the lining may be rectangular or oval, with the longer dimension usually standing vertically. In the former case the sub-divisions or compartments are usually separated one from the other by longitudinal partitions of concrete, or simply by steel posts, while in many instances the two forms are combined, giving an exceedingly strong reinforced concrete construction.

Probably the most extensive linings for steeply inclined shafts are to be found in the Lake Superior copper region, on Keweenaw Point, where the shafts are usually sunk on lodes that dip from 35 to 80° from the horizontal. These shafts, for the larger mines, have two hoisting compartments and a manway, and therefore require an arched lining extending from the surface through 40 to 80 ft. of glacial drift, composed of sand, gravel, and boulders, down to bedrock. This detritus is water-bearing, which condition increases the difficulties of construction. The lining is carefully connected with the bedrock, drainage-holes being provided through which the excess of water can escape, thus maintaining a low head and reducing the danger of disturbing the concrete. Other important constructions of concrete and reinforced concrete, are shaft and pump-stations, which are now being widely employed in both coal and metal mines. Aside from the stations mentioned, special rooms, such as underground offices, hospitals, lamp-rooms, and stables are now being built of concrete. Lining, and the re-lining, of gangways, formerly timbered, with brick and concrete is the usual practice in the large mines of the United States. This is especially true of the Eastern coal mines, but also applies to many metal mines. Water and air-stoppings are now largely constructed of concrete, where permanency is desired. Ditches also, both in the mine and at the surface, are being made of concrete, having the advantage of durability and neatness in appearance.

Two elliptical shafts were sunk, and lined with concrete, on properties of the United States Steel Corporation, one being at Tug River, West Virginia, the other at Bridgeport, Pennsylvania. The coal department of the Lackawanna railroad re-lined at least four shafts in collieries belonging to that company in the vicinity of Scranton, Pennsylvania. These linings were of reinforced concrete, rectangular in section. They passed through 60 to 75 ft. of 'wash,' connecting the surface with bedrock. The elliptical shaft-lining at Bridgeport is 23 by 15 ft., inside measurement. The 81 ft. of lining was varied with depth, having three sections, as shown in Fig. 1, C being the lower section, B the middle section, and A the upper section or tipple foundation. This was put down as a sinking-lining or drop-shaft, being provided with a heavy timber shoe, with an angle-iron cutting-edge. The dimensions of the shoe corresponded to the middle section of the shaft-lining, B, being in fact the only portion that was a drop-shaft. Some 30 ft. of forms for the reception of concrete were built upon the shoe, after it had been leveled in the initial excavation, and the concrete placed, smoothing was done by running a long-bladed shovel up and down next to the inner form. Ten days were allowed for the setting of the concrete, after which the outside members of the forms were removed. Settlement of the lining was accomplished and controlled, in the usual manner, by evenly removing material from beneath the shoe, which method was continued until the shoe came to rest upon a hard shale, which capped the coal. About 5 ft. lower a

foundation-ring was cut, and a shell of concrete was built to the sinking-lining above, thus completing the middle section of the shaft-lining. The shaft was then sunk through the coal stratum to a point 10 ft. below it. This portion of the shaft was then lined with concrete, having the section shown at C, Fig. 1, but having, in that part contiguous to the coal stratum, openings provided for gangway connections. The upper portion of the lining was then

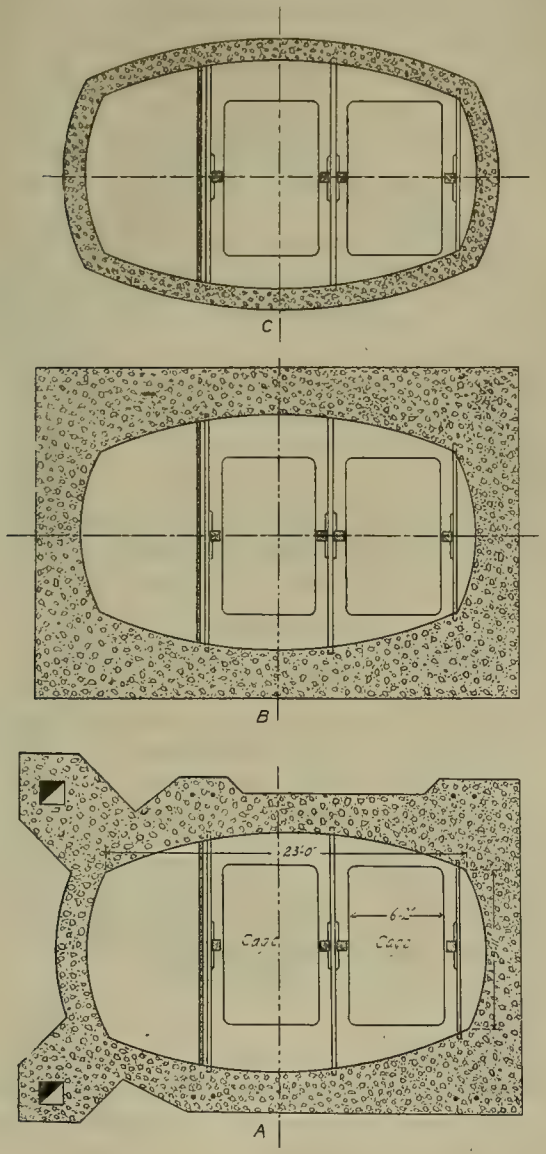
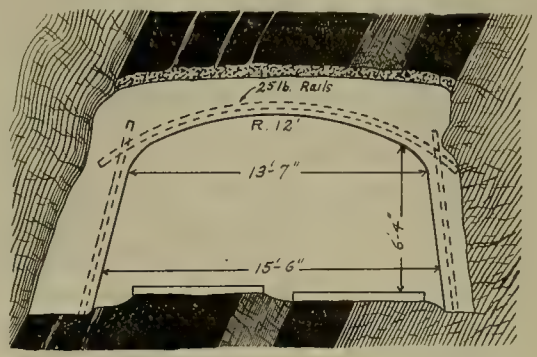


Fig. 1.

built, constituting the capping of the lining, also serving as a foundation for the tipple. (See A, Fig. 1.) Seepage of water was prevented during construction by placing strips of canvas against the rock-walls and filling the space between them and the forms with concrete. As a further precaution, iron pipes, 1 to 2 in. diam., were laid in the concrete, permitting the escape of percolating water. Subsequently, when the concrete had set, caps were screwed upon the pipes, checking the flow of water. When the lining was completed the shaft was divided into three compartments by setting three lines of 8 by 12-in. angle-buntons into the concrete walls, holes being chiseled for their reception, and when placed fresh concrete was rammed around them. This method of placing buntons has proved most satisfactory. An attempt at Tug River to use cast-iron bunton-pockets was abandoned owing to excessive leakage around them.

Probably one of the best illustrations of re-lining a timbered working is that of the Manville shaft, in the vicinity of Scranton. The lining is rectangular, and the partitions dividing the shaft into compartments were broken up into buntons by large oval openings



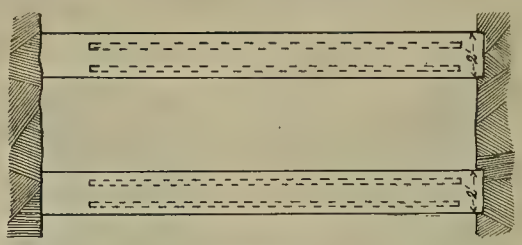


Fig. 2.

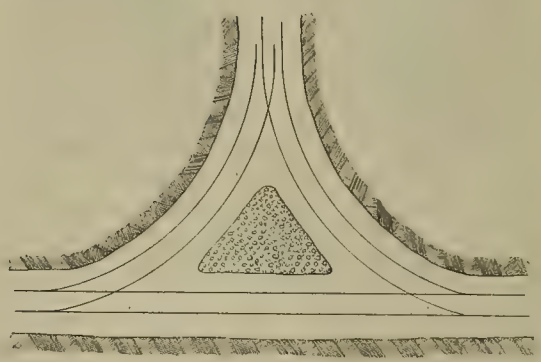


Fig. 3.

being left in them. Expanded metal and rods were used in connection with the concrete, thus reinforcing the comparatively thin walls. For details of the construction the reader is referred to No. 31 in the bibliography.

The Syracuse shaft on the Mesabi range is an excellent example of the use of a variety of methods to overcome difficult conditions in sinking; the final and successful completion of the work being largely due to the use of reinforced concrete. See reference No. 25.

Recently the Bangor shaft was sunk through

quick-sand at Biwabik, on the Mesabi range. The work was accomplished by a concrete drop-shaft, and while the use of drop-shafts is neither new nor unusual, the successful employment of reinforced concrete in this connection is somewhat of an innovation in American mining practice. As usual, a steel shoe served as the foundation of the superstructure of concrete, upon which two forms were built; an inner one of 14 ft. 6 in., and an outer one of 22 ft. 6 in., thus leaving a clear annular space of 4 ft. between the two retaining walls of the forms, which is the thickness of the shaft-lining. No attempt was made to free the shaft of water during the process of excavation, the sand being removed by dredges of the clam-shell and orange-peel types. To facilitate the use of the dredges and to control the movement of the drop-shaft, a steel cylinder 6 ft. diam. was built of flanged sections 8 ft. long, bolted together at the flanges. As the drop-shaft settled, the concrete was built up in lengths of 8 ft., reinforcing rods of high-carbon steel being set into the concrete near the outer form, also staggered somewhat to increase the area of reinforcement. The rods were looped at the ends in order that other rods might be attached as the lining increased in height. When necessary to do work at the bottom of the shaft, the water could be forced out of the inner metal cylinder by compressed air, in a manner similar to that employed in caissons, air-locks being established in the tube.

The substitution of concrete for timber in the support of drifts and gangways is well illustrated by the practice in the mines of the Philadelphia & Reading Coal & Iron Co., near Shamokin, Pennsylvania. Here concrete arches and columns for the support of the roof, where long spans are necessary, are successfully employed, and their use with similar applications is extending rapidly. The concrete arches take the place of timber sets composed of 14 to 16-in. posts and caps, lagged with 4 to 6-in. round timber, and spaced at intervals of 5 ft., centre to centre. The concrete forms were placed close to the old sets, and were built of 1 by 8-in. boards, and provided with 2 by 6-in. braces. The first arches made were 24 in. square, in sections, while the later ones are only 18 in. square. The earlier forms were reinforced by old 25-lb. rails, two being placed side by side, lying about 3 in. from the sides in the inner corners. These rails were bent to conform somewhat to the shape of the arch. In the arches last built old wire rope was used instead of the rails, being woven back and forth through the concrete. After about two weeks the forms were removed and the arches were complete. That the arches are sufficiently strong is shown by the fact that not the slightest check has occurred in any of them. The cost is approximately $27 and $22, respectively, for the 24 and 18-in. sizes. (See Fig 2.)

Triangular columns are occasionally built at certain points as, for example, where three roadways meet, leaving a large triangular space, which in many cases is much too wide for an unsupported roof, and as it is quite important that no settlement should take place, wooden cribs filled with rock or timber-supports are unsatisfactory. Concrete has been used successfully at such points, and could be used to advantage in supporting the roof at sharp corners where a road is turned from the main gangway at a small angle. (Fig. 3.) Underground stations, such as those in which pumps are placed, are now being lined and supported by concrete. (Fig. 4 and 5.)

The preservation of mine timber has been under consideration in many districts, especially in the coal mines of Pennsylvania, and has led to the establishment of a number of plants for the treatment of timber. It is interesting to note, however, that at least one large company, the Reading, has been experimenting with concrete props, which have proved so successful that it is proposed to build a plant at the North Franklin colliery, where such props will be manufactured for distribution to neighboring properties. This movement augurs well for the future of concrete in mines.

A possible and extremely practicable application of concrete is in the support of weak roofs during the extraction of coal. This use of concrete has hardly been more than tried in the United States, but is widely employed in Europe, especially in Burgundy, where thick coal-seams are worked in benches. Each bench, when the one above is excavated, is covered with a bed of concrete 8 to 10 in. thick. Being placed 12 to 14 in. below the level of the bench, this serves as a support for the tracks. The concrete is placed in sections transversely to the working face, good connection between the successive sections being ensured by leaving a feather-edge on the advancing side. Upon this bed of concrete is placed the filling with which the excavation is stowed on the removal of the coal, and by it the filling is supported while the next bench is being excavated.

As the maintenance of air currents in coal mines is so important, concrete offers great advantages. Probably no portion of the air-ways should be constructed with greater care than the 'over-casts,' and for that reason concrete is being used. Such use of concrete is shown in the coal mines at Flat Top, Alabama. See reference No. 22. The Lehigh Valley Coal Co. is substituting reinforced concrete for wood and stone 'over-casts' in the Wyoming coal region of Pennsylvania; at least four such constructions are employed in the Dorrance colliery. For the details, reference No. 23 may be consulted. Next in importance to over-casts in mine ventilation are 'air-stoppings.' The problem of ensuring brattices and stoppings against danger from explosions of gas or coal-dust has been solved by the employment of concrete. A wall of concrete is built across an air-passage at the desired point, being set into the walls, roof, and floor to a sufficient depth to prevent leakage of gas or air, and to give adequate strength. Occasionally an opening is left in the stopping, which is further provided with a canvas or wooden door, this being known as a 'brattice explosion-door.' The door is usually placed at such a height, and is of such size, that men can readily pass through, and will permit a large volume of gas or air to pass, should an explosion break it down, thus relieving the fan

from undue pressure, which might otherwise damage or demolish it. Where air-stoppings can be placed in abandoned or little-used passages, and where such stoppings are so situated that their effect in checking the force of explosions will not result in damage to the fan, air-tight constructions may be employed. The use of concrete in such work is now common practice, and as light construction is most desirable, reinforced concrete is usually employed. The reinforced concrete stoppings at the Flat Top mine in the Birmingham district, Alabama, may be taken as typical of such work. In order to ensure a good contact between the walls and the concrete, so as to

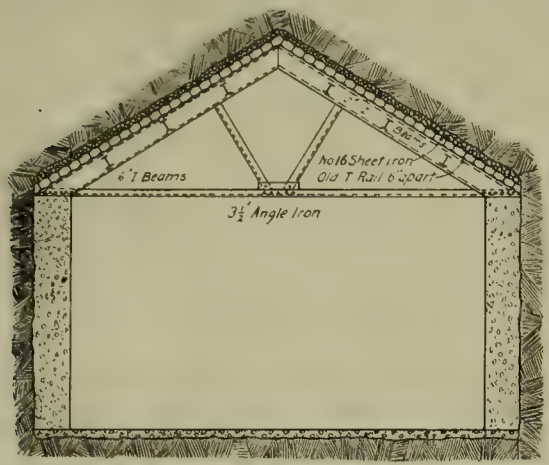


Fig. 4.

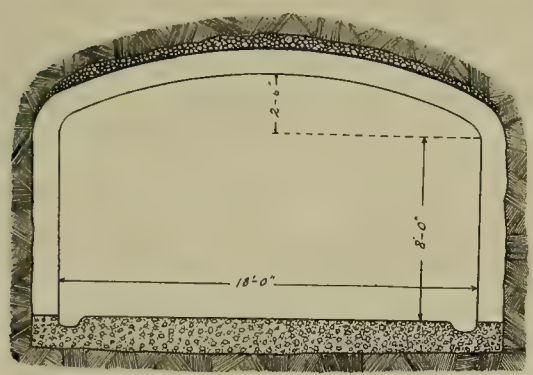
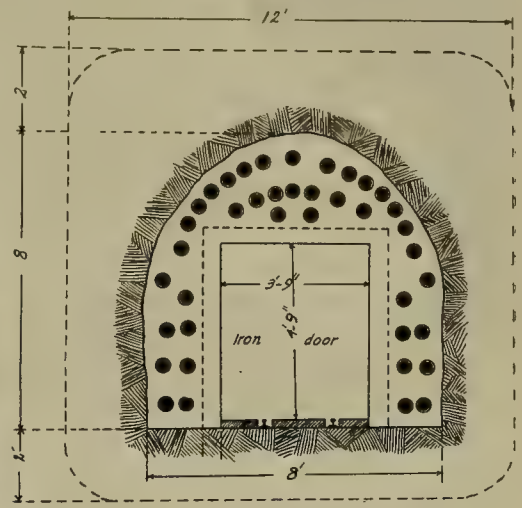


Fig. 5.

prevent leakage of air, the walls, roof, and floor are carefully dressed and recessed to a depth of several inches. Wire netting of about 2-in. mesh is stretched across the opening, which, with the recessing, may be made as much as 10 ft. square, and fastened temporarily by iron pins driven into the walls. Two widths of netting are usually employed, of such width as to overlap a foot or more in the middle. A form is then erected on either side and the concrete placed, being carefully rammed, especially around the walls. The usual thickness of such stoppings is 8 inches.

As a protection to miners and workings, bulkheads are often built in gangways and tunnels. The reinforced concrete bulkheads recently erected in the main Ontario adit, which was driven as an extension into the property of the Daly-West mine, at Park City, Utah, are excellent examples. These bulkheads are placed in the adit at points 100 ft. or more back from the intersections of passages employed in skirting caved ground. The Ontario adit has a rock-section 5 by 7 ft., and as the bulkheads are 12 ft. square in the vertical plane, the walls must be recessed to a depth of $3\frac{1}{2}$ ft. on the sides and $2\frac{1}{2}$ ft. on the top and bottom. The bulkheads are 9 ft. thick, and have, therefore, a comparatively large



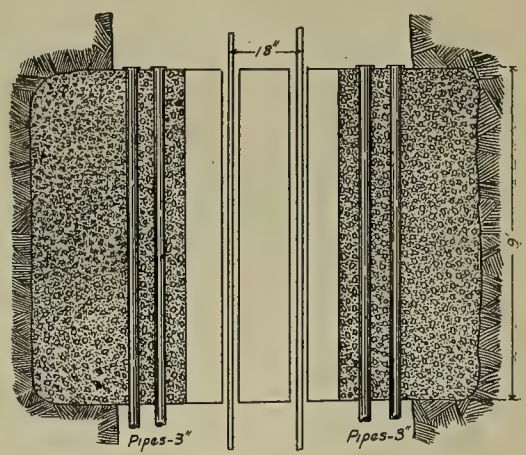


Fig. 6.

superficial area, parallel with the tunnel. In the centre of the bulkheads is an opening 4 by 5 ft., in the clear, to serve as a doorway for the passage of men, cars, etc. The door is of reinforced concrete, consisting of ¾-in. plates and 10-in. I-beams, securely bolted together, the latter standing vertically, facing the workings. The plates being bolted to the flanges of the I-beams, that portion to which the hinges are attached consisting of double thickness, made by two plates. The spaces between the plates and I-beams are filled with concrete, thus making an extremely strong and impervious construction. As a precautionary measure, forty 3-in. pipes, provided with valves, are set into the concrete, forming a double row of openings approximately paralleling the sides and top of the doorway, by means of which the pressure upon the bulkhead may be increased or relieved at will. (See Fig. 6.)

The use of concrete in intercepting ditch construction is shown to good advantage in the water-rings used at the Phillips plant of the H. C. Frick Coke Co. of Fayette county, Pennsylvania. (See Fig. 7.) One of the first uses to which concrete was put was that of building foundations for heavy machinery, engines, pumps, compressors, and reducing machinery, etc., its use not being confined to the surface only. Retaining walls of concrete for the support of fills, as when site for buildings must be partly excavated and partly filled or built up, are now of common occurrence. These should be provided with drainage holes. Retaining walls are preferably built in vertical sections or panels, each panel being a day's work; this eliminates horizontal joints. Panels should be built alternately, the intermediate spaces being filled afterward.

An important use to which concrete has been put is in the support of tracks. Large longitudinal stringers are built; upon these the rails are mounted and to these they are securely bolted. Such concrete stringers are in use at the Ahmeek, Mohawk, and other mines in the vicinity of Calumet, Michigan. In Fig. 8 is shown a section of the shaft and a transverse section of a concrete stringer, encased in the mold, as may be seen at the Ahmeek mine. Preparatory to placing the stringers, the foot-wall or floor of the shaft is cleared of loose material and the mold-boards placed. Before filling the concrete, the space between the walls of the mold is flushed to bedrock, ensuring a clean face for the concrete. Through the centre of the stringer runs an old wire rope 1⅛ in. diam., which has proved to be ample as reinforcement. Such concrete stringers have been in use in the Ahmeek mine for four or five years, being entirely satisfactory. This work was done under the superintendence of W. J. Uren.

A further extension in the use of concrete in and about mines is its employment in the construction of powder magazines. Underground magazines are as a rule simple in construction, consisting as they do, in most instances, of blind drifts or old stopes, walled off from the rest of the workings, and equipped with thawing racks and steam pipes. The concrete partitions are provided with iron doors and ventilating flues, while the floor of the magazine is of concrete, in which are drainage ditches leading through the partition. The heavy iron doors are securely locked. Powder magazines for the storage of explosives on the surface must have larger capacity, and are often built of concrete. The magazine of the Doe Run Mining Co. at Flat River, Missouri, is shown in Fig. 9.

An application of concrete employed in Europe, and that might be adopted with advantage in the United States, is in the form of reinforced plates or slabs for shaft-lining. Such plates have been successfully used at the Koenig colliery, in the Saar district, Germany. Blocks 9½ in. thick, and of a length equal to the longer dimension of the shaft-section, are reinforced by ⅝-in. iron rods spaced from 2 to 4 in. apart, and running longitudinally through the plates. They are still further reinforced by 6-in. ribs, two to a plate, and built on the side opposite the inside of the shaft. When in place the corners are strengthened by angle-irons, 2 by 2 in., which, with additional rods placed in regular order about the shaft, give ample support for the preliminary operation of lining. Finally, concrete is rammed between the plates and the walls, uniting the plates with the rock. The plates then serve the double purpose of a form and a finished wall, both simplifying and cheapening the operation.

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Tungsten in ores may be determined as follows, according to Ekeley and Kendall (*Mining Journal*, Feb. 22, 1908): The ore is decomposed in the usual manner by digestion with aqua regia in a flask. After diluting and decanting through a filter, the residue is washed repeatedly with a 5% solution of NaCl until the washings show no acidity when tested with ethylamine solution and phenolphthalein. Allow as little as possible of the WO_3 or insoluble residue to get onto the filter. When washed, the filter is put into the flask, disintegrated, and a sufficient excess of standard ethylamine solution added. The flask is stoppered and allowed to stand in the cold, with occasional shaking, until solution of the WO_3 has been effected. The solution is then titrated back with standard oxalic (2.8 gm. per litre) and phenolphthalein indicator. The amount of ethylamine which has been neutralized by the WO_3 serves as a basis for the calculation. The ethylamine solution is made by using 6 gm. of a 33.3% alcoholic solution of the base in one litre. 1 c.c. equals about 0.005 WO_3.

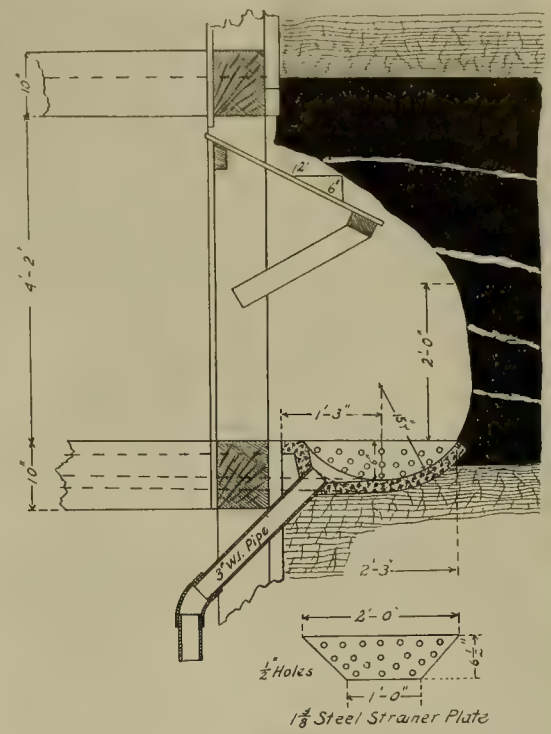


Fig. 7.

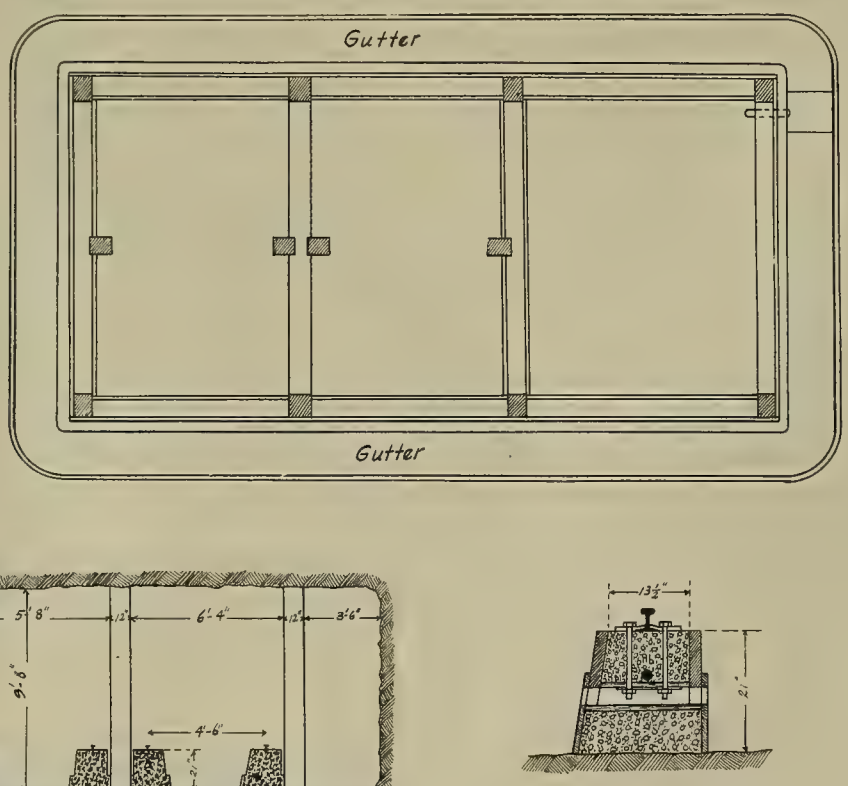


Fig. 8.

OVERFLOW FROM DREDGE PITS AT OROVILLE.

There has recently been much discussion as to whether the colored water flowing into the Feather river from the tailing piles of the dredges could have an injurious effect upon the river. In an effort to obtain exact information upon this point, six samples were taken on November 29 by interested parties. The samples were as follows:

No. 1. Outflow from under the tailing piles at the bank of the river, near Gold Run, discharging about 10 miners' inches.

No. 2. About 100 yd. downstream from No. 1, opposite a big riffle in the river, about 40 miners' inches flowing out from the cobble piles.

No. 3. Water crossing from the east of the Marysville road into the tailing piles to the west, near the dam in the ditch east of the road and just south of the bridge crossing Gold Run.

No. 4. Outflow from the pit of a dredge, about 15 miners' inches.

No. 5. From above the dam in a dredge pit.

No. 6. Outflow from the pit of a dredge.

These samples were sent to a well-known assayer in San Francisco, with instructions to determine the foreign matter in grains per gallon, and also to ascertain the fineness of this suspended matter.

His report states that each sample was mixed by careful shaking and one litre drawn off. This was evaporated to dryness, and the weight of the total solids determined, as follows:

Mark.	Grains per U. S. wine gal. of 58,415 gr.	Per cent by weight.
1	187.783	0.32
2	215.772	0.37
3	274.092	0.46
4	753.468	1.29
5	2029.466	3.47
6	1014.733	1.73

Experiments were then made to determine the fineness of the suspended matter in the water. In the case of each sample all of this matter passed through a 200-mesh screen. The suspended matter consisted of silt of the finest grade. The solids shown in the above table included the solids in solution, which are always present in river water. To determine these latter, two samples of the clear river water were taken and their solids determined to be 8.854 gr. per gal., equal to 0.0151%. These amounts deducted from the corresponding items in the table leave the true amount of suspended matter in the waters under consideration, as shown in the following table:

No.	Grains per U. S. wine gal. of 58,415 gr.	Per cent by weight.	Solids in solution, gr. per gal.	Net suspended matter, gr. per gal.	Per cent suspended matter.
1	187.783	0.32	8.854	178.929	0.305
2	215.772	0.37	8.854	206.918	0.355
3	274.092	0.46	8.854	265.238	0.445
4	753.468	1.29	8.854	744.614	1.275
5	2029.466	3.47	8.854	2020.612	3.455
6	1014.733	1.73	8.854	1005.879	1.715

For the purpose of determining the size of the particles, a microscopical examination of the sediment was next made. Slides were prepared by evaporating small portions of each sample to dryness and measuring the sediment both with a stage micrometer and with an eye-piece micrometer. Under the microscope the sediment is seen to consist of an infinite number of particles of approximately the same size. These particles show a tendency to cake on drying, but under a strong light it was possible to see the individual pieces, and to measure them with a fair degree of accuracy. The particles in both samples vary in size from one one-hundredth to one four-hundredth of a millimetre. These dimensions reduced to decimals of an inch are respectively 0.0003937 and 0.0000984 in. The coarsest particles of suspended matter in the discolored water flowing into the river (samples 1 and 2) were only about $^1/_{10}$ the size of flour particles, and the finest but $^1/_{40}$ of that size. The material escaping into the river on November 29 contained from 0.30 to 0.35% of this extremely fine powder, or from 178 to 209 gr. per gal. The reports of the United States Geological Survey on 'The Surface Water Supply of California, 1906', show the flow of the Feather river on the dates specified (page 120), stated in miners' inches, to have been:

Date.	Flow, second-feet.	Miners' inches.
February 16, 1906	11,500	460,000
February 28	19,600	784,000
March 15	18,400	736,000
March 22	23,000	920,000
March 25	48,600	1,944,000
April 11	18,400	736,000
April 16	18,100	724,000
April 25	17,000	680,000
April 25	16,600	664,000
May 2	18,800	752,000
May 11	22,100	884,000
May 17	12,000	504,000
July 6	7,190	287,600
July 26	2,860	74,400
September 5	1,760	70,400
October 12	1,620	64,800
November 1	1,610	64,400
December 10	3,270	130,800

Such extremely fine material would not settle in a stream having a velocity of 2 miles per hour. As a matter of fact, material so finely divided does not settle short of tide-water. The bed of the river-channel consists of sand as far down-stream as Suisun bay. It is interesting to note that the river is scouring its channel deeper, from Sacramento down as far as the surveys in progress by the Engineering Corps of the United States Army have extended, which is about 14 miles. The same phenomenon is reported by the survey corps at Marysville.

Volcanic action has been considered to be caused by a development of heat resulting from radioactivity in limited tracts, at a depth of one to three miles from the surface, which may sometimes be sufficient to melt the rocks affected by it. The melting is gradual, and when a sufficient quantity is melted, the water which it contains becomes explosive and usually suffices to break through the covering, constituting an eruption. When all the lava is erupted, and the reservoir is exhausted, it closes up for a time. If the heat continues to be generated, more lava is melted, and in due time another eruption occurs.

TREATMENT OF THE GOLD AND SILVER PRECIPITATE AT DOS ESTRELLAS.

Written for the MINING AND SCIENTIFIC PRESS
By WALTER NEAL.

At the clean-up in the Dos Estrellas mill, El Oro, Mexico, the gold and silver slime flows by gravity through launders from the zinc-boxes, first onto a 20-mesh screen, next to a 60-mesh screen, and thence to the first of two cement sumps. The short-zinc resting on the 20-mesh screen is returned to the head compartment of the zinc-boxes after being thoroughly washed: that passing 20-mesh and resting on 60-mesh is dried and melted, without acid treatment. From the first sump above mentioned the slime overflows to a second, whence it is pumped to the filter presses by a triplex plunger-pump. The idea of using two sumps is to hold back the greater part of the slime in the first, thereby enabling the pump to be run at full speed till work on the boxes is finished, and the zinc-room man can give more attention to the press. Then while the sumps are being pumped out, short-zinc is washed and the launders cleaned. Lastly the heavy sludge in the first sump is pumped out, and the sumps thoroughly washed.

After the clean-up is completed the precipitate is partly dried by passing compressed air through the cakes in the press. The press is then discharged into a movable steam-jacketed drying car which is run under the press to receive the cakes, then returned to its place, and connected to the steam line, the cakes being left to dry all night. A small vertical boiler is used for generating steam for this purpose, and is fired for about two hours, the fire then being 'banked' and the steam allowed to drop slowly. The cakes are melted the succeeding day; they contain only about 18% moisture. Until recently the precipitate was briquetted after fluxing, but this has been discontinued on account of the amount of handling involved. At the present time the precipitate is handled only twice, as against six times in briquetting, as follows:

Briquetting.

1. Cakes knocked from filter-frames to drying-car; and the car wheeled to place and steam connected.

2. Cakes shoveled from drying-car to fluxing-boxes; weighed; and fluxes added.

3. Mixed with shovel in boxes; and boxes wheeled to briquetting-machine.

4. Precipitate shoveled from boxes to hopper of briquetting-machine.

5. Briquettes lifted from briquetting-machine by hand and placed in boxes; and run to furnaces.

6. Briquettes placed in shovel and fed into crucibles.

Without Briquetting.

1. Cakes knocked from filter-frames to drying-car, care being taken not to break up cakes more than necessary; car wheeled to place, steam connected, dried, weighed entire, fluxes spread evenly over top of precipitate (without mixing), car run to furnace.

2. Precipitate and fluxes shoveled to crucibles.

Briquetting is a good thing, and it is also well to mix the fluxes intimately with the precipitate, but no one who has ever got some precipitate on his finger and tried to wipe it off on his overalls will dispute the statement that handling is a bad thing and spells 'loss'. Further, the precipitate at Dos Estrellas seems to melt as readily and to give as clean a slag without as with mixing. Care being taken not to break up the cakes as they fall from the press is almost as good as briquetting to prevent the precipitate from caking superficially and 'blowing' during fusion. The loss by dusting of such wet material is negligible. The flux generally used is:

Precipitate	100
Borax	15
Soda bicarbonate	8
Sand	4

Scrap wrought-iron in excess.

The precipitate yields from 60 to 80% bullion. Coke is used as fuel at the two plants of the Dos Estrellas Co., but fuel oil by the El Oro and Mexico companies. Number 400 Dixon or 371A Morgan crucibles are used, each crucible holding about 86 kg. of mixed precipitate and fluxes. After fusion the upper portion of the molten mass in the crucible is poured into a conical mold with a clay-stopped tap-hole about three inches above the apex. The lower portion is poured into ingot molds. As soon as a shell of slag about ½ in. thick has formed in the 'tapping-mold' the clay plug is removed and the fluid central core is allowed to flow into another mold. A sample of the issuing slag is taken and granulated by being poured into water. The 'shells' from the conical molds, and the slag from the ingot-molds are remelted, poured into conical molds, and tapped as before. The cores are sacked and shipped at intervals to the smelter.

The slabs of bullion from the ingot-molds, together with the buttons from the tapping-molds, are remelted, no attempt being made at refining. On pouring the final bars two samples are taken: the first from the crucible after skimming the molten metal, and the second while pouring the bars. It is of interest to note that in 12 months, during which time a total of 35.23 metric tons of bullion was melted, the total difference in value of the bullion as indicated by the two samples was only ₱1963.69. The sample taken while pouring gave the higher results.

The short zinc passing 20-mesh and resting on 60 carries from 5 to 10% of metal and is melted with the following flux:

Short-zinc	100
Borax	40
Soda	20
Sand	10
Lime	5

This flux gives a very fluid slag carrying about 40% zinc and exceedingly poor in gold and silver. The resultant metal carries about 20% zinc. Being so small a quantity in proportion to the total amount of bullion, the 'zinc metal' is added to the slabs of metal which come from the screened precipitate at the second melting.

LUNA COUNTY, NEW MEXICO.

Written for the MINING AND SCIENTIFIC PRESS
By E. McCORMICK.

Luna county, in the southwestern portion of New Mexico, comprises five districts, namely: Floridas, Tres Hermanas, Stonewall, Cooks, and Victorio, all in the vicinity of Deming, where a custom lead-smelter is in operation, the latter two districts being its chief feeder, although other portions of the territory, especially Magdalena, are drawn on from time to time, as necessity warrants. In the eighties all these districts except the Stonewall were productive, especially Cooks and Victorio.

Florida is 12 miles southeast of Deming, isolated and surrounded by the great alluvian plain. The rock mass is granite, porphyry, and limestone. The ore occurs along the contact and in the lime, and as found comprises carbonates and sulphides of lead and copper, both carrying a little silver. Nothing but surface mining has as yet been attempted, due no doubt to the limited capital of the companies operating. Of late, copper has been receiving the most attention, the latest find being in the porphyry near the lime contact. To date the district has been credited with approximately $75,000, of which $60,000 was extracted previous to 1885.

Tres Hermanas is an alluvial plain extending for 25 miles south of Deming. It is broken by a cluster of three peaks from which it derives its name, meaning 'three sisters.' The formation and the ores are identical to those found at Florida. Here the Carboniferous series flank the range, being supported by the igneous members beneath. All development has shown the deposits to be only on the surface. The ores are principally lead carbonate with an occasional pocket of what is locally known as lerchenite, no doubt hydrozincite. Here again we find development only in initial stages, although the district is well mineralized and worthy of investigation.

So far, the Cincinnati group is the only one of any prominence; it has produced material to the value of $125,000.

Stonewall is a district 35 miles southwest of Deming, and is now dormant. In fact, but little development was ever attempted, the gold ores being of low tenor.

Cooks is 20 miles north of Deming, and is reached either by wagon, trail, or railroad. It derives its name from one Philip Cook, said to be the first white man to have scaled it. It is one of the most conspicuous landmarks of the county, towering to a height of over 12,000 ft. The mountain is mainly of eruptive rock, flanked by Carboniferous limestone. The mineralization occurs along the plane of contact, the chief deposits being in the limestone. The important mines are those belonging to the American Smelting & Refining Co., namely the Graphic and the Summit. The former was considered a great property years ago, having produced in the neighborhood of $2,500,000, but of late they have reached the sulphide zone and are operating in an indifferent manner. The same can be said of the Graphic, which has a shaft 635 ft. deep, the deepest in the district, which is also idle at present. A large deposit of fluorite exists which will no doubt in time find a market, lack of transportation at present preventing. Cerussite, plattnerite, and galena are the principal minerals found. Discoveries in the line of extensive bodies of low-grade lead-zinc sulphides have been exploited, but water is lacking, so experiments on dry concentration are under way. Should this prove successful it would revolutionize the camp, as the carbonates are almost exhausted. Records credit the district with the handsome production of $4,000,000.

Victorio district is situated 24 miles west of Deming, and at present is the most prominent camp in the county. It derives its name from being one of the chief haunts of the Apache Indian chief, Victorio. This district has produced in the neighborhood of $2,500,000, and is favorably situated for economic mining. Here again we find limestone intersected by reefs and dikes of eruptive rock. The ores consist of galena, cerussite, and anglesite, hübnerite, and scheelite also occurring but only in very limited amounts. The orebodies were undoubtedly formed by infiltration, the mass being well mineralized, and the ore-shoots regular. They offer good indications for deep-seated deposits. On the whole, the county seems to be well endowed with lead which must shortly command the attention of investors.

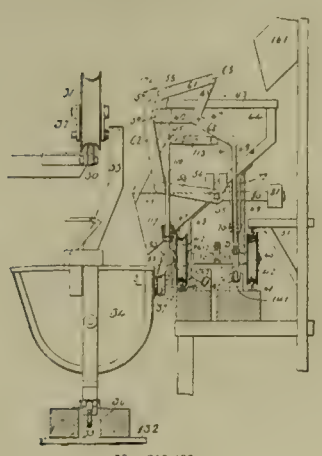
As described above, the ores are oxidized, so that smelting must be resorted to, and as the gangue consists principally of limestone and ferruginous material they make desirable products for smelting. There is an independent smelter at Deming, the only lead-silver plant in the territory. This enterprise purchases all kinds of lead ore on the most liberal terms, thereby infusing new life into the mining districts of New Mexico and Arizona. Here a 75-ton blast-furnace is in operation, but plans are now under way to increase its capacity by another unit, making it 150 tons, at the same time installing a small copper stack. Situated as it is on three important lines of railroads, the Southern Pacific, Santa Fé, and El Paso & Southwestern, its position is excellent. Fuel-cost is low, the plant being operated by Hornsby-Akroid crude oil engines, the oil costing 4.8c. per gallon, so the actual consumption per horse-power-hour is one pint. The plant has now been in operation three years, and has demonstrated its efficiency. It offers nothing new metallurgically, but the following data on the cost of supplies delivered at the works, may be of interest:

Coke, $7.10 per ton; coal, $5.25; wood, $4.50; iron ore assaying 74% FeO, $2.75; lime, $1.50. Labor is cheap and efficient, foremen and engineers receiving $4, dippers and feeders $3, laborers $1.25, pot and charge wheelers $1.75, 12 hours constituting a day's work.

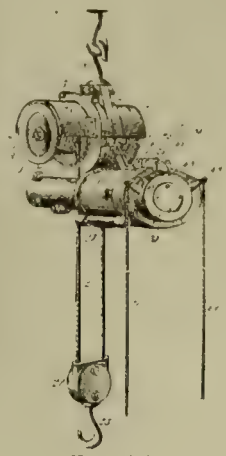
It is stated that the building of a large new electric power station in Lapland is shortly to be taken in hand. Either the Norr or Söderland falls will be used, and it is proposed to erect the power-station close to the Bräunland railway station, and within about 10 miles of the sea. The power available is estimated at 88,000 horse-power.

MINING AND METALLURGICAL PATENTS.

TRAMWAY LOADING DEVICE.—No. 910,499. Charles A. Case, New York.



No. 910,499.



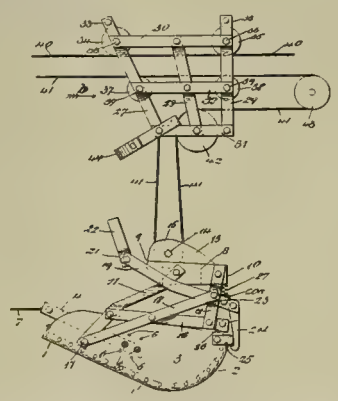
No. 910,708.

The combination of an aerial tramway, a bucket propelled by a hauling rope of said tramway, a loading hopper supported on tracks adjacent to said tramway, a shaft that can oscillate about and move along its axial line supported on the loading hopper, an arm extending from said shaft, a roller journaled on the bucket in the path of said arm, a second arm extending from said shaft, a wedge located in the path of the second arm to engage therewith and thereby disengage the first arm and the roller on the bucket.

ELECTRIC HOIST.—No. 910,708. William O. Duntley, Chicago, Illinois.

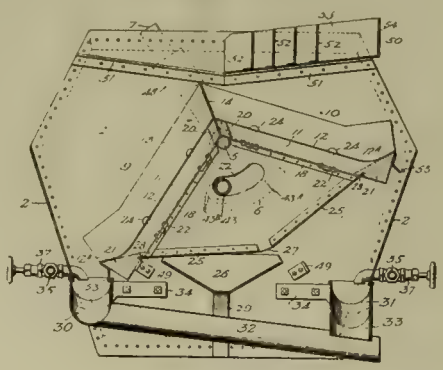
In a device of the character described, a plurality of winding drums, a driving shaft actuating said drums, a motor casing, a plurality of motor armatures, a field magnet common to said armatures, transmission gearing for said armatures, an auxiliary shaft secured to said motor casing, a plurality of contacts mounted on said auxiliary shaft, a casing for said contacts, a trip arm adapted to shift said contacts, and means to lock said contacts in shifted position.

EXCAVATING APPARATUS.—No. 910,055. Dayton H. Gilson, Rushville, Indiana.



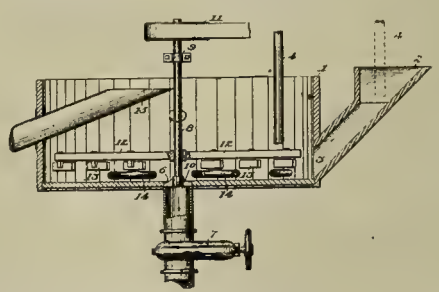
In an excavating apparatus, the combination with a supporting frame, and a scoop pivotally connected at its forward open end portion to said frame, of a depending latch pivotally connected to said frame, and a catch situated at the rear end of said scoop to be engaged by said latch to support the end of said scoop, a bail adjustably secured to said scoop and adapted to project at its forward end, beyond the open end portion of said scoop, a hauling rope connected to the forward end of said bail, whereby, when the scoop is unlatched to depend from its pivotal centre, said hauling rope is operated to swing said scoop into position to be engaged by said latching means.

OSCILLATING SCREEN FOR ORE AND OTHER MATERIALS.—No. 911,113. Albion B. Colcord, Kokomo, Colorado.



In an oscillating screen, a pair of angularly disposed screens, which abut at their upper ends, a shaft to which said screens are attached, an adjustable counter-weight attached to said shaft and arranged to hold said screens in material receiving and screening position until the load of oversize material on said screen outweighs said counter-weight, said shaft and its counter-weight and said screens being arranged to oscillate a predetermined distance in alternate order from an operative ore receiving and screening position to an oversize discharging position, means including a hopper for flowing material over said screens in alternate order at each end of the oscillating movement of said screens, means for collecting the screenings product of said screens, means for leading the oversize product of said screens from them and collecting it together, means including piping for flowing jets of water against the under side of said screens in alternate order when in their oversize discharging position, and means including piping for flowing a supply of water into the oversize material after its discharge from said screens.

APPARATUS FOR CONCENTRATING ORES.—No. 911,077. Walter M. Sanders, Marion, Kentucky.



Apparatus for concentrating ore by flotation, comprising a tank having means for introducing ore and solution below the normal liquid surface, a central discharge gate for tailings, a substantially central overflow for concentrate, and a mechanical agitator constructed to impart a whirling motion to the liquid in the tank, to agitate the ore, and to transfer the tailings to said central discharge gate, substantially as described.

AMMONIA-CYANIDE PROCESS OF TREATING ORES CONTAINING PRECIOUS METALS.—No. 911,254. David Mosher, San Francisco, California.

The improvement in treating ores and tailings containing gold and silver, which consists in extracting the precious metals with a solution of ammonia and an alkaline earth-metal cyanide.

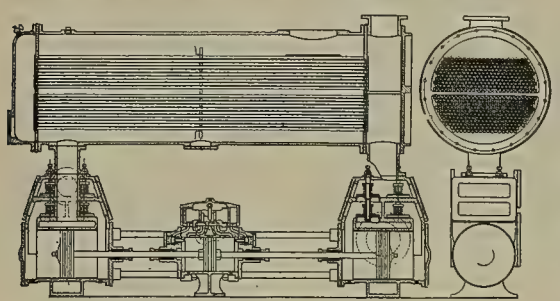
The improvement in treating copper, nickel, zinc, and cobalt ores and tailings with gold and silver values, which consists in simultaneously extracting all the metals with a solution of ammonia and an alkaline earth-metal cyanide.

Cameron Surface Condenser.

This apparatus is especially recommended for locations where the water supply for condensation is salt or unfit for boiler-feed, and where it is desired to save the condensed steam for that purpose. It will readily maintain a vacuum of 26 in. referred to a 30-in. barometer when supplied with sufficient cooling water.

The condenser is mounted on top of a direct-acting combined air and circulating pump, the three cylinders of which are in a straight line; the steam-cylinder in the centre and the air and water cylinders at each end. By this arrangement a very smooth and steady running pump is ensured, as the regulating action of the water-pump equalizes the irregular lead on the air-pump.

The water-chamber of the condenser rests directly on top of the water-cylinder and the circulating water passes upward from the water-cylinder and through the lower bank of tubes, returning through the upper bank and out at the highest point of the water-chamber. The arrangement is such that no air can lodge in the condenser-tubes and impair



their efficiency. Exhaust steam entering the top of the condenser near the circulating water outlet, spreads along the entire length of the condenser before passing on its course down through the tubes where it is condensed, and finds its way by gravity to the air-pump as condensed water, air, and non-condensible vapors.

The condenser shell, water-chamber, and covers, are cast-iron. The tubes are seamless drawn brass, and are secured at each end into muntz-metal tube plates by means of brass screw glands packed with corset-lace packing. The tubes are free to expand and contract, but are held from getting out of place endwise by a shoulder in the screw-glands. Where the tubes are long they rest in a support-plate placed midway in their length. In all cases they are relieved from any impact of incoming steam by a baffle-plate placed opposite the exhaust-steam inlet. The condenser can be opened up and inspected without disconnecting any of the pipe connections.

The steam-cylinder is of the well known Cameron type, with no outside valve-gear, and makes its full stroke every time. The steam-cylinder heads are removable without disconnecting any of the other parts. Both pump-cylinders are brass lined and are fitted with brass pistons arranged for fibrous packing. The piston-rods are of Tobin bronze and separate at the steam piston. The valve system in both air and water cylinders is of the usual Cameron arrangement. By removing the cover at each end of the cylinder every valve is exposed to view. Each valve-stem holds two valves with their springs one above the other so that by simply unscrewing one plug and pulling out the stem both are released. The air and water cylinders are in the most accessible position for inspection and repairs, and the air piston and valves are submerged at all times.

The A. S. Cameron Steam Pump Works are prepared to build all sizes of surface condensers up to 1500 hp., and can furnish condenser shells of sheet steel or copper where lightness is a factor, or pump ends of all brass if desired. Where there is not sufficient head room, the condenser may be placed alongside the pump, but in all cases it should be high enough for the condensed water to flow by gravity to the air-pump.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

BOLETIN DEL CUERPO DE INGENIEROS DE MINAS DEL PERU. No. 67. Issued by the Ministerio de Fomento, Lima.

ANNUAL REPORT OF THE MINING INDUSTRY OF IDAHO FOR 1908. By F. Cushing Moore, State Inspector of Mines.

THE GUADALUPIAN FAUNA. By George H. Girty. Professional Paper No. 58 of the United States Geological Survey.

WESTERN ELECTRICAL AND GAS DIRECTORY. Published by the Blanchfield Publishing Co., San Francisco. Price $10.

This volume contains a list of all the electrical, gas, railway, and kindred companies operating in the States of Arizona, California, Nevada, Oregon, and Washington. It also contains a list of the contractors and dealers in each city of the States named. It should prove a valuable handbook to anyone interested in the electric or gas industries.

Commercial Paragraphs.

THE HERCULES GOLD MINING CO. of South Dakota has ordered Butters filters for its mill, which will be erected by Allis-Chalmers Company.

THE PACIFIC TANK CO. and the NATIONAL WOOD PIPE CO. advise us that in order to handle their increase of business in the North, they have opened a new office at 210 Wells-Fargo Bdg., Portland, Oregon.

THE BRODERICK & BASCOM ROPE CO., St. Louis, Missouri, announces that the Western Equipment Co., 72 Fremont street, San Francisco, will in the future carry a large stock of 'Yellow Strand' wire rope, drilling cables, and sand lines.

WARREN WOOD, of the WOOD DRILL WORKS, Paterson, New Jersey, and ROBERT J. WOOD, manager of the Chicago branch, will leave the United States on February 19 for a three weeks visit to the Panama Canal zone for the purpose of inspecting the work being done by Wood rock drills, and upon their return the Wood Drill Works will publish a booklet containing valuable cost data and comparisons, with some interesting views along the canal.

Catalogues Received.

THE EUREKA DRILL STEEL CO., Denver, is distributing a circular which presents some conclusive arguments in favor of Lug steel for drills.

THE DEAN BROS. STEAM PUMP WORKS, Indianapolis, Indiana, has published, under date of January 1909 its catalogue No. 74 on condensing machinery.

THE INDUSTRIAL INSTRUMENT CO., Foxboro, Massachusetts, has lately published its Bulletin No. 16, describing its revolution counters, tachometers, and tachographs.

THE C. O. BARTLETT & SNOW CO., Cleveland, Ohio, is distributing its catalogue No. 28 illustrating and describing steamship fuel lighters, and coal and ash handling machinery.

THE DENVER FIRE CLAY CO., Denver, has lately issued two bulletins: one on muffle furnaces for coal, wood, coke, and oil; and one on Case melting furnaces for gasoline, gas, or oil.

THE WESTERN LUBRICATING VALVE CO., Denver, has recently published its catalogue No. 2, which is an attractively printed and illustrated pamphlet describing the Western lubricating valve and its advantages for use on rock-drills.

THE CYCLONE DRILL CO., Orrville, Ohio, has lately published its catalogue B-20, which illustrates and describes blast-hole machines of the rod and cable types, the traction machine, blast-hole loaders, and sounding and boring outfits.

THE HENDRIE & BOLTHOFF MFG. & SUPPLY CO., Denver, has issued under date of February 1 an odd stock sheet. Certain articles, that are either odd stock or second hand, are listed at a net selling price, which should be an advantage to one needing such machinery on short notice.

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EDITORIAL.

ON MAY 7 the American Electrochemical Society will meet in annual convention at Niagara Falls. By reason of the unusual attractions, scenic and industrial, of the place of meeting, there should be a large attendance. Mr. Edward G. Acheson is president.

CONDITIONS of travel vary so much and have so important a bearing upon the work of the mining engineer that we hope the article on 'Travel in Colombia' will prove of service to the mining profession. It is written by one who knows South America well and is desirous of helping the investigators of mineral wealth attracted by the recent development of the country.

THAT is sensible comment which comes from London, criticizing the sudden leap in the market price of shares in Lake View Consols mine, just because the workings on the 1900-foot level had penetrated a streak of high-grade ore. It takes more than one swallow to make a summer, more than one glittering pocket in a mine to send a stream of golden bars to bank. The Lake View sequel is that an expansion of over a million dollars in the market valuation of the stock was occasioned by $250 worth of ore.

A NECESSARY aid to the growth of industry, be it mining or any other, is easy, prompt, and inexpensive means of communication. Our relations with South America have been sadly hampered by inadequate mail facilities. The ship-subsidy bill, which passed the Senate the other day, was intended to promote closer communication with South America and Australia. This was killed in the House, but it is hoped that the new Congress will not fail to meet the demand of the people for a widening field of activity. In mining and commerce Latin America offers larger opportunity for our enterprise than any other part of the world.

THE National Good Roads Association will hold its annual convention at Baltimore next month. The influence of the Association is awakening the interest of legislators throughout the country in a subject that had fallen into neglect by reason of too great concentration of attention upon the railroad as the chief means of communication. But the railroads find their local business expanding in proportion to the improvement of the highways, and have become earnest abettors of the propaganda which the National Good Roads Association is making. With good roads and the automobile, the 'back country' districts will at least not be backward, but will be opened to the advantages and comforts of

civilization. This is a matter that concerns the miner and the farmer and all citizens, rural and urban. The headquarters of the Association are in the Opera House Building, Chicago.

CONFIRMATION of churn-drill sampling by shafts in the testing of placers, as insisted on by Mr. W. E. Thorne in his article published in this issue, is a point that will appeal forcibly to every man who has had experience in gravel-mining. Mr. Thorne declares that no ground is proved conclusively until some shafts have been sunk, and these should follow drill-holes, in order that, if discrepancies be found, the causes may at the same time be determined. Thus a means for interpretation of drill-results throughout a large area is supplied. The article is a sound statement of correct practice by one who knows.

NEW ZEALAND was the country in which gold-dredging practice was developed to success, and although no longer a leader in this branch of mining, it is interesting to note that 34 dredges are at work in the South Island; these produce about 1000 ounces of gold per week or a million dollars per year. The maximum production from this source was in 1905, when over 3000 ounces were extracted in one week, but even this when shared among 75 dredges does not represent mining on a large scale. The Yuba Consolidated, at Marysville, California, wins $1,250,000 profit from about $1,650,000 gross output of gold annually, and accomplishes this with 12 dredges. That is something like mining.

DITCHES constitute an integral part of mining operations. The making of a ditch at a minimum cost for a maximum efficiency is a pretty bit of engineering, and therefore the article by Mr. Douglas Waterman will be welcomed. Those who read the article will agree with us that he has made a notable contribution to technical literature. Such practical details tied by scientific principles are of immediate value to the operators and superintendents of mines. We hope other men versed in the subject will contribute further data. While in Alaska recently we were given the following figures concerning cost of maintenance in the Rampart district: the ditches are 2¾ to 4½ miles long, the cost of maintaining them in serviceable condition ranged from $468 to $2250 per mile per season or $24 to $74 per miner's inch of water. These are high costs, due to the peculiar regional conditions described in recent articles in this journal. Of course, the biggest undertaking of this kind in the North is the Yukon ditch, which will come into use during the approaching season.

NOT LONG ago *The Evening Post* printed some doggerel making fun of the tariff hearings on zinc. In course of time these verses reached Great Britain, and the President of the Board of Trade, Mr. Winston Churchill, in a speech at Nottingham stated that he had received an official report in the course of which it was said that "the people in Kansas and Missouri who thought their interests would be affected by the tariff alterations on zinc ore, were singing in chapels a hymn, the refrain of which was:

So now we humbly pray that we
Be saved from ruin's brink;
We will accept whate'er must be,
But Lord remember zinc."

These were the jesting verses published by *The Evening Post.* The story reminds one of the three crows and the ensuing exaggeration.

MR. TELLER complained in the Senate the other day that the plans for the construction of the Panama Canal are changed every six months, to which Mr. Kittridge added that the proposed site for the Gatún dam had been shifted eleven times. The criticism conveys an unjust impression: it assumes that the engineers should have made a thorough study of the situation before excavation was started. Beyond doubt such a preliminary would have been most proper, and Congress might have appropriated money years ago for that purpose, but whenever an examining commission was appointed it was sent to bring data in a hurry to promote action on some treaty or bill to rush the business through. The behavior of Congress in regard to the Panama Canal reminds us of the common habit of mining companies, which want a mill before the mine is proved, and erect expensive headworks before development has shown where to place the permanent shaft. Hence the subsequent history of the enterprise, if it end not in a crash, is one of eternal change and everlasting assessment. Such a policy lends no more cheerfulness to the directors' meetings than similar congressional errors have contributed to the crestfallen committeemen who have to provide for the absorbent Isthmian enterprise. It is the part of wisdom to get ready first; it costs more to get ready afterward. It is not the engineers who are to blame for making changes in the light of better understanding of conditions; it is the gentlemen at Washington who sent out junketing expeditions instead of authorizing the long and costly tests needful for elaboration of plans before commencing work. Now we must blunder along to the end, no matter how it swell the budget. The ultimate benefit will justify the cost.

Theodore Roosevelt.

This week has witnessed the inauguration of another President of the United States. The event is remarkable more because of the retirement of Mr. Roosevelt than for the incoming of Mr. Taft, for the latter has yet to make his mark as chief executive while the former steps down after nearly eight years of extraordinary activity. Before pronouncing an epitaph on his administration let us see how the alien world regards his accomplishment. Unquestionably in Europe the influence of Theodore Roosevelt upon the development of American life is appraised more highly than in his own country. Nor is this surprising; to those who are near, the smoke of battle obscures the commander; the noise of approval and of disapproval drowns the accents of the

speaker. Most of us are partisans, not spectators. Therefore, it is well to listen to the opinions of those who, by virtue of geographical and mental detachment, can more nearly anticipate the cool verdict of posterity. To them the ex-President is a great and useful man, epitomising qualities distinctively American. The fuss and fury of impulsive speaking, the personal encounter with political opponents, the wire-pulling of machine politics, the almost tiresome versatility of the man, and the cock-sureness of the strenuous reformer are not impressed upon the consciousness of the student of modern history resident at Vienna or London. From these points of vantage Theodore Roosevelt looms to heroic size, he is regarded as a fearless fighter against corruption, as a tremendous power for righteous dealing, as an uplifter of national ideals. And shall we fall behind the European in admiration of this remarkable American? Has he not fought our battle, is he not the strongest leader of reform and the most powerful foe of special privilege; is he not the one man who has been able to check the predatory captains of industry who seemed but recently on the verge of controlling our political life? The answer is obvious; yet we are reminded of the definition of a friend as "the man whom you know and still like." So we honor Mr. Roosevelt while seeing much to deprecate. His faults, however, are distinctively American and therefore lovable to his own people. The American likes to "do things" regardless of precedent, he possesses an impatience of restraint that gradates easily into disregard of law; this tendency the ex-President has repeatedly expressed by word and deed; he will go down in history as the executive who cut through red tape with cheerful confidence; and many consider that he performed useful service in so doing, for the United States is burdened with a written constitution which is so difficult to adapt to modern problems that it has required almost a revolutionary to make changes seemingly necessary. From this difficulty Mr. Taft may find escape in a way more pleasing to a lawyer than the disregard of precedent shown by his predecessor. New interpretations of the constitutional provisions may be found by the legal mind of a President who was intended for a judge of the Supreme Court. Nor is analogy lacking—and a respectable one too: the New Testament during the centuries has undergone such diverse interpretation as to supply the fundamental tenets for countless sects; it may be that Mr. Taft will so interpret the American political testament as to achieve Mr. Roosevelt's purpose in a more orthodox manner. Something had to be done. Mr. Roosevelt in his seven or eight years of power has accomplished what otherwise might have required the time of a generation. And this is what the mass of the American people like, having made up their minds that something had to be done to check the corruption that was sapping the foundations of industrial civilization from New York to San Francisco, and from Chicago to New Orleans. He made blunders, but they are deemed well meant; he proved himself a deft politician, but the wires on which he played were occasionally too evident; he was boisterous in his praise of friends as in his condemnation of enemies, but that was considered his breezy way. The public at large took him at his word and liked to see human frailties that brought him closer to themselves. "He made good." For ourselves, we are glad to have seen these years of Rooseveltian disturbance; we have been amused at the hissing of the votaries of the ticker whose speculative debauches he interrupted; we have appreciated the meaning of the hate expressed by the "malefactors of great wealth" as being a tribute to his sincerity; we have noted the applause of the men who hope for the development of representative government and the retention of the American idea of equality of opportunity to all. In stepping down from his high office to become the first citizen of the United States, Mr. Roosevelt takes with him the grateful appreciation of millions and the hope that he may be spared to a long life of great usefulness.

Copper.

The hope has been expressed that the lower prices for steel, due to the recession from an artificial position, would stimulate the buying of copper; it being held that the abnormal cost of steel had hindered the industrial development which creates a demand for copper. That seems logical, but it will not supervene until the steel manufacturers leave an open market; at present copper is unprotected either by tariff or trust; steel is buttressed by both. Meanwhile copper at 12½ cents is approaching that danger line at which the profits of many mining companies will vanish. In general terms the American copper output of 3,500,000 pounds per day is produced at a cost of slightly over 10 cents per pound, but many mines produce the metal at 11 or 12 cents per pound, and these are endangered. To any director or shareholder believing in a better market for copper, it must seem suicidal to consume the ore reserves of his mine in the effort to make a niggardly profit, such as the Greene Cananea with a cost of 10½ cents or the Shannon with costs at 12 cents per pound. Yet some of the mines that produce copper on the smallest margin of profit, such as the Anaconda and other Amalgamated properties in Montana, are among the biggest factors in overloading a glutted market. Of course, the Calumet & Hecla people can afford to refuse to join in any 'combine' in possible violation of law, and they can assume a position as painfully independent as it is painfully moral to the Amalgamated directors, simply because the Calumet & Hecla produces copper at 8½ cents and can earn $37 per share even with copper at 13 cents. If the mines operating on the ragged edge will persist in flooding the market with metal the production of which will profit them but little while it spoils the sale of that produced by other mines, the price must continue low, until an automatic rise follows in the wake of industrial expansion. The copper-selling agencies occasionally permit so-called authoritative statements to be published in the daily press with a view to bolstering public confidence and

persuading consumers of the metal that a rise is imminent, but these efforts are pathetically funny, they remind one of Mrs. Partington when she tried to sweep back the incoming tide with her broom. The Amalgamated people, particularly, have twice essayed to control the price in defiance of economic conditions and twice have they been hoisted by their own petard. To the onlooker the copper people are plainly at sea, drifting in a fog of misinformation. In the course of time the new statistical venture of the Producers Association may cast light through the gloom; in the meantime to the man with one eye it looks as if too much copper were being produced and too little sold, the consumer chuckling at the efforts of the producer to boost the price in the face of slackened demand. When a fire underground threatened to stop production in the Anaconda mine, the shares of other copper mines went *down*, although it is obvious that the misfortune of a big mine would cause a decrease in the output that was swamping the market. This is an example of the artificial conditions created by stock-market manipulation.

Railroad Rates.

The mining industry of the Rocky Mountain region and of the Pacific Coast is in a fair way to gain long needed relief if the decision just rendered by the Interstate Commerce Commission in favor of Spokane be applied as a ruling principle. Familiarity with discriminative freight rates has not destroyed the sense of impropriety that a man experiences in seeing his car of mining supplies go bumping past his station to San Francisco or Los Angeles, to return a week later with the added local rate from the terminal city to the final destination of the shipment. The long-haul anomaly is opposed to an innate feeling for justice. The economic reasons are explicable, that is, the railroads can make out a case, but under cover of the principle as put in practice discriminations are made that work severe hardship. The case of Spokane has for years been prominent as an example of the flagrant misuse of the opportunities for favoring certain shippers presented by place-discrimination in fixing rates. The instance of the wooden pipe industry is well known in the history of the rate-struggle. Spokane had developed that business to large proportions. A rival in Seattle made a bargain with the railroad which enabled him to lay down pipe in Spokane nearly 60 per cent cheaper than it could locally be produced. It was shown that the Seattle firm, by reason of favoring rates, could even deliver pipe at Butte at the cost of manufacture in Spokane. Other examples of discrimination existed in the fixing of a rate per hundred pounds on iron pipe from Chicago common points to Spokane at $1 while to Seattle the rate was 50 cents; on mining car-wheels the respective rates were $1.26 and 85 cents; on wire and manufactures of wire $2.35 and $1.50. The average advantage enjoyed by Seattle over Spokane by reason of these preferential rates has been about 80 per cent.

The importance of the decision now rendered is that a principle long urged as a remedy against unjust discriminations has been applied. It may seem to depart from the old common law idea, which recognizes that the burden of proof rests upon the plaintiff. Though the rates as fixed by the railroads are often offensive through their rank disregard of public right, they are not offenses in a legal sense. The railroad is an arm of the government by reason of the license that enables it to profit as a common carrier. As such it must demonstrate the necessity for its acts. This is the finding of the Interstate Commerce Commission. It issues a warning to the railroads in these words: "Water competition may justify a difference in carload minimums and in the right of combining different commodities at the carload rate, as well as the rate itself; but carriers should be prepared to justify such preferenee." The point is one of large significance. Possible water competition is not the same as actual rivalry. In proportion as parallelism between a rail and water-route is approached the magnitude of the time-factor disappears. This has been conspicuous in the influence of the Great Lakes in controlling rates, but the enormous loop around a continent which a ship must follow in proceeding from New York to San Francisco reduces active water competition to a minimum, for the time in transit for sailing ships averages about six months, and almost half that time is required by steamships. The method of the railroads has been to distribute the estimated earnings in accordance with the expected volume of traffic on the basis of competitive rates by water to Pacific ports, while the interior towns have been made to pay the difference.

The principle of protecting the seaport in its advantage as a distributing point within its own particular zone of commercial attraction, is not disturbed by the decision; it is only the enormous disproportion between the charges for the long and short hauls that the railroads must justify. In addition, the Commission materially advances the position of those who regard the railroads as existing primarily for the good of the general public. The fifth, seventh, and ninth findings in the decision declare in unequivocal terms that railroad earnings shall not be excessive, and that the public at large shall not be unduly taxed for the sake of distributing a surplus to stockholders. The recognition of the railroad as a public-utility enterprise is made more explicit by this notable document. The earnings of the Great Northern and the Northern Pacific railroads are declared to have been excessive in recent years. In consequence, the Commission has ordered a horizontal reduction in the rates to Spokane equivalent to about 16⅔ per cent. If applied to other points as a general principle, it will work a revolution in rates from Eastern points, the benefit of which will be particularly felt in the mining regions of the West from Canada to Mexico. The Interstate Commerce Commission early last autumn smashed the absurd regulations that made it cheaper for a California miner to ship his stamp-mill from Chicago to Shanghai and back to San Francisco than to bill it in the rational way. Another step forward has been taken for the relief of the West.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

R. A. F. PENROSE is in British Guiana.

KARL EILERS was in San Francisco for a few days.

JOHN B. FARISH will be in San Francisco on March 9.

EDWIN HALL has been appointed State Geologist of Wyoming.

FRANK W. OLDFIELD is examining mines near Parral, Mexico.

EDGAR RICKARD left London on March 3, returning to San Francisco.

HENRY BOSSUAT is manager of the Dos Estrellas mine, at El Oro, Mexico.

E. F. YATES, lately at Rawhide, Nevada, is here on his way to Mexico.

RUEL C. WARRINER is now manager of the Crown Mines, in the Transvaal.

ROBERT LINTON was in San Francisco on his way to Portland, Oregon.

C. M. HAMSHAW, of New York, will return to Fairbanks, Alaska, in March.

RICHARD C. SHAW is examining mines near Mojave, for Los Angeles capitalists.

D. C. FESSENDEN has left Manhattan, Nevada, and is now at Riverside, California.

DOUGLAS WATERMAN has gone to Amador county, California, to examine mines.

S. H. BROCKUNIER has returned from Juneau, Alaska, to Wheeling, West Virginia.

PIERRE BOUERY is manager for the Lagrange Mining Co. at Weaverville, California.

E. P. MATHEWSON, of the International Smelting & Refining Co., is in Salt Lake City.

FRANK ANDERSON, of Salt Lake City, is engaged in professional work at Globe, Arizona.

A. V. THORNS has resigned as superintendent for F. G. Manley, near Hot Springs, Alaska.

ANGUS R. MACKAY, of Montreal, is manager of the Vulture mine, in Maricopa county, Arizona.

C. W. WHITLEY, manager for the A. S. & R. Co., at Salt Lake, has gone to Europe on a holiday.

S. E. BRETHERTON, metallurgical engineer, announces a removal to 311 Mills Bdg., San Francisco.

GEORGE Z. EDWARDS is manager for the Cannon Ball M. & M. Co., operating in Blaine county, Idaho.

W. SPENCER HUTCHINSON, of Boston, was in San Francisco on his return from the Vulture mine, Arizona.

HOWARD P. SAUNDERS, mechanical engineer, Salt Lake City, is making drawings for Fink smelting furnaces.

F. C. ROBERTS has resigned as manager of the Ventanas mine, Durango, and will engage in business in San Francisco.

EDGAR L. NEWHOUSE, vice-president in charge of smelting operations for the A. S. & R. Co., visited San Francisco this week.

HENRY C. BEELER, formerly State Geologist of Wyoming, has opened an office as mining engineer at 222 Boston Bdg., Denver.

J. PARKE CHANNING has been elected vice-president of the General Development Co., of which Adolph Lewisohn is president.

GEORGE E. DRISCOLL is mill superintendent for the New York and Honduras Rosario Mining Co., at San Juancito, Honduras.

J. N. HOWELL and J. W. KINGSBURY have become partners in engineering and geological work and have opened an office in Salt Lake City.

L. WEBSTER WICKES, formerly with the Gunn-Thompson Co., has opened an office in the Judge Bdg., Salt Lake City, to engage in mining engineering.

FRANK A. KEITH has resigned as manager for the Tonopah Mining Co., Nevada, and has opened an office in the First National Bank Bdg., San Francisco.

VANCE C. OSMONT, formerly consulting engineer to the Nevada Mining Reduction & Power Co., of Dayton, Nevada, has opened an office as a mining engineer in the Monadnock Bdg., San Francisco.

THOMAS COX, formerly at Ely, Nevada, will leave Cerro de Pasco, Peru, and is expected in San Francisco in June. He will join EDMUND JUESSEN, and the firm will have offices in San Francisco.

Latest Market Reports.

LOCAL METAL PRICES—March 4.

Antimony	12@16c	Quicksilver (flask)	44@45
Electrolytic Copper	15¼@16¼	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33⅜c

ANGLO-AMERICAN SHARES.
Cabled from London.

	Feb. 25. £. s. d.	Mar. 4. £. s. d.
Camp Bird	0 15 9	0 15 9
El Oro	1 3 9	1 3 9
Esperanza	3 1 3	3 2 6
Dolores	1 10 0	1 10 0
Oroville Dredging	0 11 3	0 10 6
Mexico Mines	4 12 6	4 15 0
Tomboy	0 17 6	0 17 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

SOUTHERN NEVADA STOCKS.
San Francisco, March 4.

Atlanta	$ 11	Midway	21
Belmont	85	Montana Tonopah	75
Booth	18	Nevada Hills	1.35
Columbia Mtn.	12	Ophir	1.00
Combination Fraction	86	Pittsburg Silver Peak	74
Daisy	53	Rawhide Coalition	46
Fairview Eagle	10	Rawhide Queen	—
Florence	3.45	Round Mountain	80
Goldfield Con.	7.80	Sandstorm	12
Gold Kewenas	16	Silver Pick	8
Great Bend	17	St. Ives	14
Jim Butler	16	Tonopah Extension	70
Jumbo Extension	11	Tonopah of Nevada	6.75
MacNamara	33	Tramp Con.	10
Mayflower	13	West End	33

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Feb. 25.	Mar. 4.
Amalgamated Copper	66⅛	67⅛
American Smelting & Refining Co.	79¾	80¾
Boston Copper	11⅜	12
Butte Coalition	21½	23
Cumberland Ely	7⅛	7¾
Dolores	5⅛	5¾
El Rayo	2⅞	2⅞
Giroux	7	8⅛
Greene-Cananea	9⅛	9⅞
Indiana Sonora	3¾	3¾
La Rose	6⅜	6⅜
Miami Copper	12⅞	13⅜
Nevada Consolidated	16½	17⅛
Newhouse	4¼	4⅛
Nipissing	9¼	9¼
Ohio Copper	6½	6¼
Tennessee Copper	36½	37¾
Utah Copper	39⅞	41
Yukon	4¼	4¼

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. March 4.		Closing prices. March 4.
Adventure	8	Mass	4½
Ahmeek	135	Mohawk	63
Allouez	39	North Butte	68¼
Arcadian	5	Old Dominion	50
Atlantic	15	Osceola	130
Calumet & Arizona	103	Parrot	28
Calumet & Hecla	620	Santa Fe	2⅛
Centennial	29½	Shannon	14
Copper Range	75	Superior & Pittsburg	14⅞
Daly-West	9½	Tamarack	81½
First National	6⅞	Trinity	13¼
Franklin	13	United Copper Con.	12¼
Granby	92	Utah Con.	40½
Greene-Cananea, ctf	10	Victoria	4¾
Isle Royale	28½	Winona	5
Lake	17⅞	Wolverine	147

(By courtesy of E. F. Hutton & Co., 490 California St.)

General Mining News.

ARIZONA.

MARICOPA COUNTY.

The Vulture Mines Co. has re-opened its mines at Vulture at the initiative of W. Spencer Hutchinson, of Boston, and Angus R. Mackay, of Montreal. Work began last September and has been pursued with the most gratifying results. The principal openings of new ground have been on the 350 and 450-ft. levels, where orebodies have been discovered of encouraging character. Ten of the 80 stamps have been repaired to serve as a test, and 85 to 87% of the gross value has been extracted by amalgamation, under the direction of Chauncey Wetmore. The cyanide annex has so far not been brought into use. Robert Johns is mine superintendent.

MOHAVE COUNTY.

W. S. Phillips, of Chicago, is reported to have made arrangements to build a 20-stamp mill in the Goldflat district; and W. De Lancy Granniss has come from New York to see about the development of a mine in the same region, making Kingman his temporary headquarters.——Three hundred tons of freight have been hauled from Chloride to the Colorado river, as part of the material for the dredge of the Colorado Dredging Co. It is expected to have the machine ready before the season of high water in the river. ——O. F. Kuencer reports that he is opening up the 500-ft. level of the Golden Gem mine with conspicuous success. A delay in the arrangements for a water supply has been the only reason to prevent the starting of his mill.

PINAL COUNTY.

The American Boy mines, 7 miles from Casa Grande, have been closed down on account of water. H. V. Elliott, the superintendent, has ordered a pump, and is devoting the time until it comes to prospecting with a core-drill. The shaft is 252 ft. deep, and there are 300 ft. of drifts on the 200-ft. level. R. J. Wessell and J. R. Meyer, two of the directors, have lately been on the property.

YAVAPAI COUNTY.

The Territorial Geologist, William P. Blake, has written a paper on the Minerals of Arizona, showing their occurrence and association, with notes on their composition.—— H. H. Keays, manager for the Bockariz Mining Co., states that the mill for treating the ore from the Gold Ring and Etta mines will be in running order within 10 days, and that the cyanide plant will be ready a few days later. The plant will have a daily capacity of 25 tons, and comprises amalgamation and concentration, with cyanidation of the tailing.——The Arizona Gold Lodes Co. holds title to the R. H. Burmeister property on Cherry creek, and is constructing a mill close to the mine shaft, under the direction of W. W. Elliott.

YUMA COUNTY.

Thomas H. Finnegan, of Bouse, Judge Stilwell and Charles McDonald, of Phoenix, are the owners of the Calcite Copper Co.'s mines, five miles from Vicksburg. They have a shaft 120 ft. deep at a contact between quartzite and porphyry, the first 80 ft. of which were sunk through calcite and iron sulphide carrying no valuable minerals. The remainder of the shaft, however, has been in copper sulphide, and has given cause to expect rich results with farther development.

CALIFORNIA.

INYO COUNTY

The Inyo Mines Syndicate has purchased the old Tower mine, in the Yellow Jacket district, a few miles south of Benton, from the trustees of the late John F. Millner's estate, and intends to get the mine into productive condition. It has been worked at various times since 1876, producing much high-grade silver ore with a little gold, and the directors of the Syndicate, W. W. Watterson and W. Gillette Scott, expect to make use of the pumps, boilers, hoists, etc., already on the ground.——The Greenwater Copper Mines & Smelter Co. is essentially a holding company, possessing no ground of its own, but holds a controlling interest in the mines of the subsidiary enterprises. Its annual report for the year ending December 31 shows that it owns nearly all of the issued stock of the Greenwater & Death Valley Copper Co., of the United Greenwater Copper Co., and of the following companies: Governor Greenwater Copper Co., El Capitan Copper Mining Co., Iron Clad Greenwater Copper Co., and Eagle Mountain Water Co. Of its workings the Copper Queen shaft No. 2 has been the most promising, and work for the past year has been confined to this shaft, which has been sunk to the depth of 1098 ft. In addition to sinking this shaft, there have been run 886 ft. of drifts and cross-cuts. The mine operations at Greenwater are conducted under the management of John McGee, who was engaged to succeed Jerry Rourke, the former manager. The report shows a balance of $138,130 cash in hand.——The Modock mine was worked a score of years ago for the Hearst and Haggin interests; last spring it was opened again by John W. Kelly, and more rich ore has been produced from it. Only high-grade ore, however, can be shipped, for it has to be brought 13 miles on burros to Darwin, before hauling the remaining 25 miles to the railroad at Keeler.

PLACER COUNTY.

A 250-ft. adit is being run to work a deep channel at the White Oak, near Forest Hill. Near the same place, at the Canothus, John Gavin is reported to have struck a rich body of gravel.

SHASTA COUNTY.

The Afterthought mines and smelter in Shasta county belonged to the Great Western Gold Co., and are situated at Ingot, 35 miles east of Redding, and on Platt creek 9 miles north of Redding. It appears that the Afterthought Copper Co., an Arizona corporation, has secured control of the mines and smelter and also the Liberty claim on the Shasta copper belt. The terms of purchase include the payment of $1 and 8,000,000 shares of the capital stock by the new owners, the principal of whom are O. E. Adams and S. E. Bretherton.——The Delta Consolidated Gold Mines Co. has purchased the Trinity Consolidated gold and silver mines. This property comprises six claims with a 10-stamp mill, and is situated about 7 miles west of Delta. With the purchase of the Trinity, the Delta Consolidated has increased its holdings until it now controls approximately 1000 acres of mineral land in the heart of the district. Between 8000 and 9000 ft. of development have been done, and the Consolidated interests have opened up one-half of the entire development since the company became interested.

TUOLUMNE COUNTY.

(Special Correspondence).—The Porto Fino mine, in the northern suburbs of Tuolumne, is being unwatered to permit a thorough examination being made by prospective buyers.——The Gold Ship Gold Mining Co. is about to commence work at its gravel property in the vicinity of Groveland. W. J. Graham will be the superintendent.——At the Grant mine, three miles north of Italian Bar, and operated by Minnesota capitalists, a cross-cut is being driven to the vein. This was deemed necessary owing to the large quantity of water flowing into the shaft. The cross-cut will be 800 ft. long. Good-grade ore has been found while sinking the shaft.——A shoot of fine ore has been uncovered in the 1900-ft. adit at the Riverside mine, above Columbia. The orebody is 3 ft. wide and is rich in free gold, galena, and other sulphides. The mill was started up this week and is running night and day.——The mill at the Nervi mine, near Columbia, began stamping ore this week after a brief idleness. A new adit was recently started and is now 50 ft. long. During the recent severe storm an immense landslide occurred, the mill barely escaping destruction.——It is reported that a rich strike has been made in the Tarantula mine, at Jacksonville, which adjoins the well-known Eagle-Shawmut.——Louis and Edward Mason of Sonora,

are installing a Huntington mill at the Birney mine, on Bald Mtn., northeast of Sonora, for the purpose of milling the dumps on that and adjoining properties.——Work was commenced in earnest this week at the gravel mine on the Calder ranch by Divoll & Leaver, of Sonora. The property, which is situated in the vicinity of Confidence, and believed to be one of the most promising gravel mines in Tuolumne county today, has been equipped with all machinery necessary to conduct extensive operations in the most economical and workmanlike manner.——Operations are to be resumed at the Del Monte mine, in the Groveland district. For some time work will be almost exclusively confined to sinking a new shaft, which, according to present intentions, will be sunk at least 500 feet.

Tuolumne, February 26.

The Karnac Mining & Milling Co., an Eastern corporation, has obtained control of the Hancock quartz mine and what are known as the Mable mines in the Rosslyn district, about 5 miles northwest of Jamestown. According to agreement, the company must pay to the owners of the Hancock, Edward D. Leonard and wife, $50 per month during the life of the bond, which will expire in January 1914. If the bond is taken up the full purchase price of $25,000 must be paid before that date. The other claims taken over by the Karnac company have been held by A. S. J. Anderson for a number of years.——Hydraulicking will soon begin at the Alta Sonora mine at Brown's flat. A dam has been constructed below the Alta Sonora, 380 ft. long, from plans furnished by the California Debris Commission. ——J. M. Elmer, of the United Mines Corporation at Tuolumne, states that he was able to crush 100 tons of hard quartz with a 10-stamp battery and a Hardinge mill, in 24 hours.

YUBA COUNTY.

E. W. Tarr has purchased the old Blue Point gravel mine near Marysville. It was once owned by P. Campbell, who took out much gold, and still believes there is plenty left. Tarr has been taking prospective investors to view his property.

COLORADO.

CLEAR CREEK COUNTY.

The Georgetown quadrangle, an area comprising about 230 square miles in Clear Creek and Park counties, Colorado, is described by the Geological Survey in Professional Paper No. 63 by J. E. Spurr, G. H. Garrey, and S. H. Ball. The paper includes also a description of the Empire district, an adjacent area in Clear Creek county.

(Special Correspondence).—It is announced that during the present year the sum of $100,000 will be expended by the Astor-Stewart M. & M. Co., operating the Sunburst, Astor, and Scepter mines on Democrat Mtn. It is intended to bring machine-drills into use in the various workings of the properties owned, the compressor plant having already been ordered. A raise is being made from the Scepter adit, and within the next two weeks the working force is to be increased. On the western side of the mountain a force of men has been put to work in cleaning out the Sunburst and Astor workings and everything is to be placed in condition for the extraction of the medium and low-grade ore exposed. No shipments will be started until the raise from the Scepter has been completed, at which time chutes will be put in, permitting of the tramming of all ore through the Scepter adit, the portal of which is situated on the Georgetown side of the hill. The aerial tramway running to the road leading into town is to be repaired at once for the delivery of the ores, reducing the present cost from $5 to $6 per ton to about 50c. It is reported that this company will shortly start work upon the construction of a 100-ton concentrating plant. The grading has been completed, and as valuable water-rights are owned, the expense of completing the plant will be small in comparison to other mills that have been built in this district. M. J. Riley has been placed in charge of the work on the west side of the hill, while Ira Clapper will be in charge on the Georgetown side. S. D. Houseman, of Denver, is the manager of the property.——E. W. Shepard, manager for the Paragon M. & T. Co., is employing a force of men in the driving of the Paragon adit, the portal of which is situated on Leavenworth Mtn., opposite Silver Plume. It is proposed to drive this adit at least one mile to intersect the mines of the district at depth. The Paragon Co. controls a big group of lode claims on that mountain and the first one will be reached within the next 100 ft. Shepard states that the directors of the enterprise contemplate building a power-plant in Georgetown during the coming summer.—— The new 25-ton mill of the Honest John M. M. & T. Co., situated on Chicago creek, will be brought into commission during the coming week. Work on the aerial tramway is being rushed in order to have everything in readiness for the delivery of ore. This tramway will be 2774 ft. long, and will have a daily capacity of 100 tons, being operated by gravity. On the seventh level of the mine a strike of importance has just been made in the east drift. The streak measures from 10 to 16 in. wide and is worth $72 per ton in gold, silver, and lead. The drift has now been extended 100 ft. and early next week machine-drills are to be brought into use to hasten development.——Mine operators and lessees at Idaho Springs are advocating the construction of a co-operative sampler. It is contended by many that the local sampler does not pay for the full value of the ore. In case a heavy percentage of zinc is contained, it is figured that by owning their own sampler the operators can protect themselves by separating the zinc when over 10% is contained. This would save $1 per ton sampler charges and by shipping to an independent smelter another saving of $1 per ton would be effected. Figures by many operators show that the miners of Clear Creek county are robbed of between $100,000 and $125,000 yearly from this one source. It is likely that a number of operators in Georgetown, Silver Plume, Empire, Lawson, and Dumont will assist and support the new enterprise.

Georgetown, February 27.

GILPIN COUNTY.

The Tucker mill in the Quartz valley district has been purchased from the Lyons-Kyle Mining Co. by William H. Hearne, for the Hearne Gold & Copper Mining Co., which also operates the Anchor group in Willis gulch. The Tucker mill has a daily capacity of 75 tons, and is equipped with 10 rapid-drop stamps, jigs, and Wilfley tables. H. Irving Jones, who is manager of the Anchor property, will also have charge of the mill.

OURAY COUNTY.

Snow storms have been continuous around Ouray. For some days the Camp Bird mill closed down for fear of the U. S. snowslide, as the slide-break which the company constructed was entirely buried.——Joseph H. Tumbach has taken first steps in opening the Pony Express mine in the Paquin district to the north of Ouray. It belongs to the Century Mining Co., and has been idle for the past ten years. There is a dump with about 70,000 tons of low-grade ore estimated to average $11 per ton in gold, silver, lead, and copper. Should developments prove favorable a mill will be constructed.

SAN JUAN COUNTY.

The Hercules Consolidated Mining & Milling Co. had the shaft of its crusher break, necessitating a temporary shutdown at the mill. Charles Dale has more than 20 cars of concentrate now awaiting the lifting of the snow blockade so that they can be shipped to Durango.

TELLER COUNTY.

The Morris Bros., leasing on the Morning Star claim of the Acacia company, on the eastern slope of Bull hill, have installed a gasoline hoist and are getting out ore. A two-car shipment is being prepared and will be loaded this week. The lessees are driving and stoping on a well-defined vein on the 250-ft. level, with the coarse rock averaging $20 and the screening $30 per ton.——Three large solution tanks and a commodious ore-house and mill building have been erected below the dump at the Tornado mine on the southern slope

of Raven hill, by Dodge and associates, who hold a lease from the Elkton Consolidated Mining & Milling Co. The dump operators intend installing a tramway similar to the one in use at the Wild Horse and Anaconda mills.

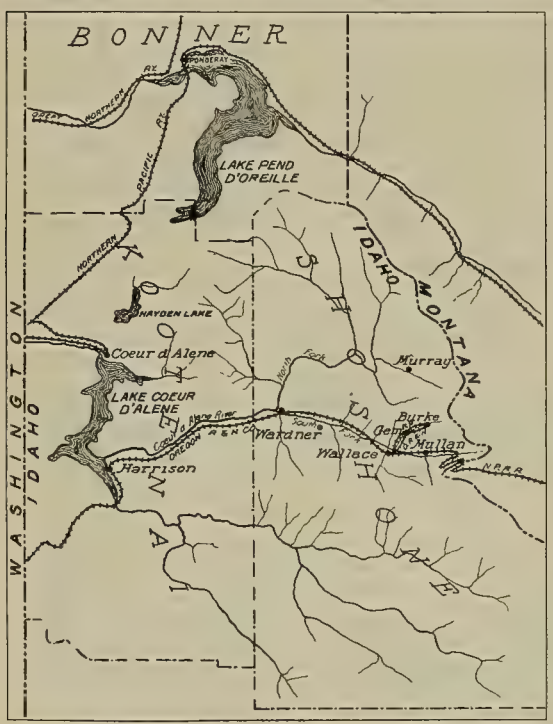
IDAHO.

IDAHO COUNTY.

Mine owners in the Elk City district in central Idaho are already contracting for the freighting of machinery into that camp, and there is every indication there will be much activity this year. F. W. Bradley reports that thousands of tons of ore are blocked out in the Buster mine, while others are nearing the shipping point.

NEZ PERCE COUNTY.

The Peck Mining & Milling Co., operating at Peck, has showings of silver and copper ore running $50 per ton. The



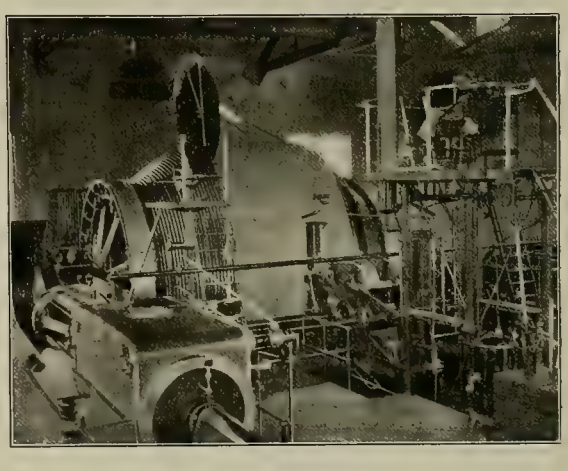
The Coeur d'Alene, Idaho.

company owns 640 acres of well-timbered land and ample water-power. Considerable ore has been blocked out for shipment to the smelter at Ponderay.

SHOSHONE COUNTY.

(Special Correspondence).—Among the important developments of the past week in the Coeur d'Alene is a strike of 4 ft. of solid galena made on the 1450-ft. level of the Standard mine at Mace. The vein has not been crosscut and the full extent of the orebody has not been ascertained. It is intended to continue the shaft to the 1600-ft. level and to commence drifting. The Standard mine is one of the properties of the Federal Mining & Smelting Co., and has paid out about $8,000,000 in dividends. The reserve in sight is now greater than at any other time in the history of the company.——E. P. Spalding, vice-president and manager of the Idaho Northern railroad, has announced that extensions of the line will be ultimately carried to Spokane and through the coalfields of Alberta. During the coming summer it is expected that a 15-mile line will be constructed on the Little North Fork for the purpose of opening up the copper and timbered areas of that portion of the Coeur d'Alene. This line will also be connected with the smelter proposed to be erected by Portland capatalists at the mouth of the Little North Fork. It is this line that will ultimately be extended into Spokane, giving at the same time a short and economical route to the Panhandle smelter. Surveys for this extension will be commenced as soon as the snow is off the ground. The extension into the Sunset country will be completed this year if possible and will start at the station of Beaver on the main line and give service to the Callahan, Nipsic, Idora, Tamarack & Chesapeake, and other properties in that region.——About 2 ft. of gray copper ore has been exposed in the upper workings of the Rainbow Mining company's property near Osburn. Work in the upper adit has been discontinued, and the management has set the men to continue the lower adit to drive about 500 ft. below the ore exposed above.——An important strike of ore has been made on the property of the Copper Age & Edison mine at Saltese. Samples of this ore taken from a 3-ft. pay-streak give an average return of 16% copper and about $47 gold per ton. The strike was made at a depth of about 500 ft. and 900 ft. from the entry of the adit.——It is proposed to advertise the Coeur d'Alene country at the Alaska-Yukon-Pacific exposition by means of a model mine representing a section through one of the great mines of the district. The section will be equipped with cars carrying representative samples of the minerals found there. The whole model will be under a mining man who will explain all technicalities and endeavor to interest visitors in the mines of the Northwest.

The Moon Creek mine near Kellogg is owned by J. M. McLain, of Spokane, and his associates. Samples from the property show 37% lead and 22 oz. silver per ton. There is



Hoist at the Trimountain Mine.

a flume 6800 ft. long with a head of 185 ft., also an electric dynamo for light and power.

MICHIGAN.

The improvement in the ore of the Trimountain mine, the lowest-grade producer of the Copper Range Co., has developed into a strike of exceptional richness. The improvement was first seen in No. 3 shaft on the fourteenth level, but is more noteworthy on the fifteenth.——The Cliff mine is diamond-drilling the Kearsarge formation on its land adjoining Ojibway on the north. The drill is running in bedrock and is expected to encounter the lode before the end of the month. The annual report of the Mass mine will show a cost of mining and shipping rock to the mill of $1.35 per ton, probably the lowest cost in the Lake district.

MONTANA.

MADISON COUNTY.

Conrey Placer Mining Co., operating dredges at the mouth of Alder gulch near Virginia City, distributed a bonus amounting to $5000 to its workmen the last pay day. The amounts ranged from $150 to $5, according to length of service. The company is controlled by New England capital, with offices in Boston.

SILVER BOW COUNTY.

The shaft of the Butte & Superior Co. has reached a depth of 1400 ft., where a large station is being cut. Some

copper ore has been found on the 1200-ft. level, and gives indication that the zinc is disappearing and copper is taking its place.——Preparations are under way for extensive operation of the Butte-Balaklava properties in this district. Plans and specifications have been prepared by R. B. Dear for a new hoist, with capacity for 3500 ft., to be operated with compressed air. It will be the only plant so operated in any of the copper producing districts of the country. The Butte-Balaklava Co. has developed important orebodies on the 300, 500, 700, and 1000-ft. levels, and has its shaft down to a depth of 1280 ft.——The Anaconda mine at Butte, has been closed down for an indefinite period on account of increased volume of gases from the fire raging in the lower workings. Some ore is being taken from below the 1400-ft. level through the St. Lawrence shaft.——While no instructions for a curtailment of copper production have been received in Butte, mining men anticipate such orders. They say that the Amalgamated mines cannot be operated on a reduced output, that they must run at normal capacity or shut down.——The assays of the ore in the vein struck on the 900-ft. level of the East Butte mine showed 9.6% copper, 22 oz. silver, and a payable amount of gold. The vein is still 8 ft. wide.

NEVADA.

CHURCHILL COUNTY.

Contracts have been placed for the erection of the first unit of 10 stamps for the Nevada Wonder Mining & Milling Co. at Wonder. Preliminary tests made by F. L. Bosqui show that an extraction of 90% should be obtainable from the grades of ore averaging $60 per ton. The mine has been opened to the 500-ft. level and several thousand feet of general development work has been done. The average value of the mine ore is $30 per ton, of which 57% is gold and the rest silver.

ESMERALDA COUNTY.

The various mills and reduction plants now operating in Goldfield handled last week, according to figures compiled by the *Tribune*, a total of 6595 tons of ore valued at $259,600, being an increase of 540 tons, valued at $25,250, over the amounts of the previous week. The Consolidated mill handled 4200 tons, averaging $40 per ton, or $168,000; Florence mill, 845 tons, at $35, or $29,600; Nevada-Goldfield Reduction Works (including 600 tons of Combination Fraction ore), 800 tons, at $40, or $32,000; and the Combination mill, 750 tons, at $40, or $30,000. It is estimated that the daily average production of the Florence mill since the stamps first began dropping is 75 tons. This is rapidly being increased.——At the directors' meeting of the Goldfield Consolidated Mines Co., held in Washington, D. C., the first quarterly dividend of 30c. per share was declared payable on April 30, instead of March 31, as had been anticipated. It was stated that the reason for this delay was the fact that the Finance Committee had decided that the company shall at all times have a reserve of $1,500,000 on hand before paying any dividend. The principal shareholders, and their holdings, are said to be George Wingfield, 500,000 shares; George S. Nixon, 250,000; H. C. Frick and C. D. Barney & Co., 500,000; Hayden, Stone & Co. and their clients, 700,000; the Hubbard interests of Chicago, 800,000; B. M. Baruch and associates, 100,000, and the general public about 700,000 shares.——A group of six claims has recently been secured by the St. Ives Leasing Co., in the Washington mining district on the East Walker river. This property was bonded to some San Francisco capitalists two years ago for $50,000 and a payment of $10,000 was made. The parties were unable to make further payments as they came due. During the past two years no work was done, and the claims became open to location. These are the claims that the St. Ives Co. has taken up by re-location.——An increased tonnage and of much higher value is being handled at the Florence mill; 135 tons of ore daily going through the 30 stamps now running. H. G. Morris, superintendent of the mill, expects to have the entire battery of 40 stamps at work in a few days, and another tube-mill is being set to aid the fine grinding. The Vantage Extraction Co. has experimented on the Florence ore, and has obtained extractions of 97% with less than an 8-hr. treatment. G. E. Wyman, of the Extraction company, is in Goldfield seeing about the installation of some of his agitators.

HUMBOLDT COUNTY.

(Special Correspondence).—The Mazuma Hills Leasing Co. has opened up a 3-ft. vein of good-grade ore on the 265-ft. level. The find was made in the north drift. Raises are being run from both levels.——F. T. Caley, one of the stockholders of the Portland M. Co., at Cripple Creek, has purchased a large interest in the Mazuma Hills mine. The Mazuma mill is running steadily on ore from the Mazuma Hills and Reagan properties.——The Kindergarten mill is treating ore from several leases. A broken cam-shaft caused a practical suspension of activities for several days.——The main building of the mill of the Darby-Nevada Ore Reduction Co. is nearly completed and the installation of machinery will soon commence. It is reported that the company is contemplating the installation of 10 more stamps. ——The Chafey M. & M. Co. is installing its custom mill and expects to be ready to receive ore within a few weeks. A large quantity of good ore is available.——Placer mining is attracting considerable attention at Chafey, and arrangements are being made to carry on extensive work. Machinery is being placed in position at several points. A fairly good supply of water is available.——The Cleghorn lease of the Consolidated L. Co., on Signal Peak ground, has installed a 3-drill compressor. The adit is in 450 ft. and will be extended 650 ft., to reach a depth of 600 ft. The adit is on the course of the vein and considerable ore has been developed.——A good deal of prospecting is being done throughout the district.

Seven Troughs, February 26.

LINCOLN COUNTY.

J. H. Maguire and H. G. Phillips have been successful in finding some fine specimens of turquoise on their property at Crescent, about 12 miles west of Searchlight. The neighboring holding is the Toltec, owned by J. R. Wood & Sons, jewelers of New York.——W. W. Hurt, of the New York-Searchlight, is putting the finishing touches to his plant. The hoist is running and the electric plant is nearly ready for generating power. The compressor has capacity for running six drills, but while only three are running the extra power will be made use of for pumping purposes.

NYE COUNTY.

John G. Kirchen, general manager for the Tonopah Extension and Montgomery Shoshone companies, says that a mill for the Extension is now assured. All the necessary plans have been submitted to the directors and the orders are to be placed for the machinery. The mill will have not less than 30 stamps and will be constructed with a view of easily adding to the capacity without interfering with operations.——Denver lessees on the Tramp Consolidated, in the Bullfrog district, continue to take out good ore. Three sets have accumulated enough sacked material to make good shipments. They cut out the rich streaks and continue to ignore the big quantities of milling grade.—— It is said that a vein over 40 ft. wide has been opened on the 155-ft. level of the Pioneer mine, with the opposite wall still unreached. Frank Keith, formerly of the Tonopah mine, is manager.——The Round Mountain Mining Co. is arranging to increase the capacity of the mill to over 100 tons per day. A compressor for 10 drills will also be shortly installed. Recent developments have resulted in the opening up of large reserves of milling ore.——It is reported that the Round Mountain Homestake Co. will shortly resume operations.——The trial run and clean-up of the Solid Gold M. & L. Co. has been made. Approximately 500 tons of ore worth from $15 to $20 per ton were handled. The test was satisfactory in every way. The capacity of the mill is 60 tons per day.——Everything is in readiness to place the Mayflower mill in commission and it is expected to commence active work within a few days. A large reserve of milling ore is blocked out in the mine and several men are employed. Sydney Addison is superintendent.——The Tono-

pah-Belmont Development Co. announces that the shaft on the Belmont claim, now 530 ft. deep, will be enlarged to 3-compartment and sunk to the 1500-ft. level. S. H. Brady is general manager.——The Round Mountain Alleghany Mining Co. has purchased the Orphan Girl, an adjoining claim.——The total output of the Tonopah mines for the past week was 5699 tons, of an estimated value (the shipping ore being valued at $60 a ton and the milling ore at $25 a ton) of $142,475. The Tonopah company sent 3150 tons, the Belmont 960, the Montana-Tonopah 739, the Midway 100, MacNamara 250, West End 200, and Jim Butler 300 tons to the mills.

STOREY COUNTY.

The weekly report from the Comstock mines show that the Ophir shipped 230 tons to the Kinkead mill and 223 tons of second-class ore to the Butters plant. Most of the ore taken from the 2000-ft. level has assayed about $23 per ton. Pending repairs to the electric pump in the Ward shaft, the 5-step centrifugal pump on the 2400-ft. level is keeping the bottom of the shaft free from water. In the Sutro tunnel, 15 ft. of advance were made driving through the cave, and an electric locomotive is being used to haul out the waste.

WHITE PINE COUNTY.

There were 33,751 tons of ore milled in January at the Steptoe concentrator from the mines of the Cumberland Ely Mining Co., the ore showing 3.09% copper, while the extraction showed a recovery of 76%. The total copper produced from the concentrator netted 1,600,000 lb., the company shipping out 1,100,000 lb. of blister copper.

S. S. Sorenson has been appointed superintendent of the smelter department of the Steptoe, in place of Walter G. Perkins, who has gone to Tanganyika in Central Africa. Sorenson has previously been in charge of the engineering work with the same company.

SOUTH DAKOTA.

LAWRENCE COUNTY.

It is reported that the Homestake Co. is planning to increase the present capacity of its slime plant. At the present time the plant is running 26 presses three shifts of eight hours each, and treating about 1800 tons of slime per day. It is said the company will build a spacious addition to the south end of the present building and install between 10 and 15 new presses. In these presses a new system of sluicing will be installed, whereby the present movable sluicing-machine will be done away with, and a much simpler device run by a shaft put in its place. The change will enable any or all of the presses to be sluiced at the same time, instead of only five as a maximum at present.

TEXAS.

ANGELINA COUNTY.

The officers and various stockholders of the Lone Star Mining Co. have been in Monterey looking over their mineral ground, which, after an idle period of a year, are now to be opened again. The company will run several adits at once, and prospects already proved will be worked.

UTAH.

JUAB COUNTY.

The new orebody found on the property of the Iron Blossom Co. is 15 ft. wide, and is considered to be an extension of the Colorado ore-shoot.——The East Tintic Co. has found a second face of ore 40 ft. below the first discovery. The new ore in the Uncle Sam holds strong, gold being found besides the silver-lead.

SALT LAKE COUNTY.

The Oregon Short Line has made the announcement that on April 3 a new rate will go into effect on ores shipped from the Goldfield and Tonopah mining camps to Salt Lake smelters, the rate touching ores of a certain grade only. Ores valued at $20 to $60 will be carried for $1 per ton less than the present rate, while ores ranging from $70 to $100 per ton will be transported for 50c. per ton less than the present schedule.

WASHINGTON.

FERRY COUNTY.

The Insurgent mine near Republic, owned by Graham B. Dennis, of Spokane, and operated under lease by William Crummer and Samuel Kerr, is shipping ore to the smelter. The first four cars averaged $39 per ton. The property is operated through a tunnel on the Lone Pine group, owned by the Lone Pine-Surprise Mining Co. Arrangements are being made to re-open several of the old properties this spring. Mining in the Republic district is a deep proposition, but before this was realized, many of the properties, prominent in the early days, had to be closed down and abandoned.

STEVENS COUNTY.

On the Dewey claim of the McKinley group (usually called by the company No. 6, there being 9 claims in the group), the cross-cut has passed 30 ft. from the foot-wall, and the hanging wall is not yet in sight. Analyses of the ore have shown the presence of copper, iron, and arsenic, in addition to the gold and silver contents. The company intends building a wagon-road from its property to the bridge across the Kettle river, at Rockcut.

OKANOGAN COUNTY.

The Conconully Copper Co., on the Salmon River Boy claim, has an open-cut 20 ft. long, showing ore from 2 to 3 ft. wide, containing silver, copper, and lead.

Mining in the Chesaw district is more active than it has been at any time in the last 10 years. The Grant Consolidated Mining Co. has several machine drills in operation, and much high-grade ore is being taken out. The shaft on the Apex property in the same district is now 250 ft. deep and found ore at a depth of 228 ft. One hundred and fifty tons of ore are on the dump assaying from $30 to $75 per ton.——The Molson Gold Mining Co. is remodeling its mill, installing rolls in place of stamps.

WYOMING.

CARBON COUNTY.

The reorganization of the properties of the Penn Wyoming Copper Co., announced from Cheyenne, shows that the United Smelters Railway & Copper Co., which is to reinstate the organization, is composed largely of the directors who had control before. E. M. Cobb, of Chicago, is president of the purchasing company; J. E. Haskell, of Bradford, Pa., vice-president; E. A. Norton, Denver, secretary, and among the directors are A. F. Baldwin, A. L. Hawse, and F. B. Draper.

CANADA.

BRITISH COLUMBIA.

There are about 550 men on the pay-roll of the Granby Consolidated M. S. & P. Co. at its Phoenix mines, and 350 men working at the smelter. It is the intention of the company to go ahead with the enlarging of the battery of furnaces, which will increase the capacity of the Grand Forks smelter another 1000 tons, giving them a daily capacity of 4500 tons; this work will be done in July or August.——The Le Roi No. 2, of Rossland, has declared a dividend of 2s. per share, payable March 11. It is understood that this is of the character of a quarterly dividend and will be followed by others at regular intervals.

ONTARIO.

The production of the Crown Reserve Co., at Cobalt, for the last two months has aggregated $320,000, and places this mine among the foremost of the camp. The directors have decided to place the company on a regular dividend basis of 24% per annum, with extra distributions which will require payments of $850,000 for the year.——The Kerr Lake Co.'s shipments for last month show earnings of $67,000, and the dividend distributions require only $40,000 per month. The company is shipping about two tons per day, netting 4500 oz. silver. For every ton sent out the company is trying to put three tons in sight.

Special Correspondence.

LONDON.

A Two Million Pound Development Enterprise.—Dolcoath Output.—Carn Brea & Tincroft.

Consolidations of mining operations are the order of the day in the Transvaal. A further step in this direction is the new scheme for raising capital by the Randfontein Estates Gold Mining Co., which owns large mines in the western part of the Rand. About a year ago a scheme was put forward by Sir J. B. Robinson, the controller of this group, for the amalgamation of the company with several subsidiaries, and for the issue of a million pounds of debentures. Owing to the depression in the financial market the issue was a failure. Since then Sir J. B. Robinson has been keeping the pot boiling himself in the hope of better times. The recent proofs of reduced costs on the Rand has renewed confidence in its future, especially as regards the extensive low-grade areas, and the time now seems ripe for proceeding with the development of the Randfontein group. It is stated that an issue of £2,000,000 worth of debentures has been underwritten, so that success is assured. The debentures are stated to be 6% and exchangeable later on for ordinary shares at some agreed figure. If this issue prove a success the development of low-grade Rand ores will advance rapidly. The whole of the two million pounds is to be used in working capital in developing orebodies and providing plant, a fact which in itself indicates the prodigious character of the scheme.

Dolcoath, the premier metalliferous mine in England, showed results for the second half of 1908 differing but little from those it has achieved during the last eight years. The average ore crushed has been 100,000 tons per year, and the concentrate sold 1800 tons. To be precise, the figures for the second half of 1908 were 49,869 tons of ore crushed, yielding 902 tons of concentrate, or a product of 40½ lb. per ton. The total amount realized was £70,238. Two years ago, in boom times, the receipts were £30,000 greater from the same amount of ore. The working costs were £61,494, and lord's royalties £4724, leaving a net divisable profit of £5891, which, with the amount brought forward, makes a balance of £9528. Out of this £8500 is being distributed as dividend, which is at the rate of 5% per annum. It is interesting to note that since Dolcoath was turned into a limited company in 1895, the total ore raised has been 1,210,674 tons, and the concentrate produced 25,846 tons. The gross receipts have been £1,844,254, the working costs £1,308,459, the lord's royalties £94,902, and the net profits £440,872. Progress in sinking the new main, or Williams, shaft is slow. The total depth is now 2274 ft., and the rate of sinking is only 42 ft. per month. The shaft is circular, and it is being lined with 9-in. bricks. It is expected to cut the main lode at 2800 ft., and it will greatly facilitate the working of the lower levels of the mine.

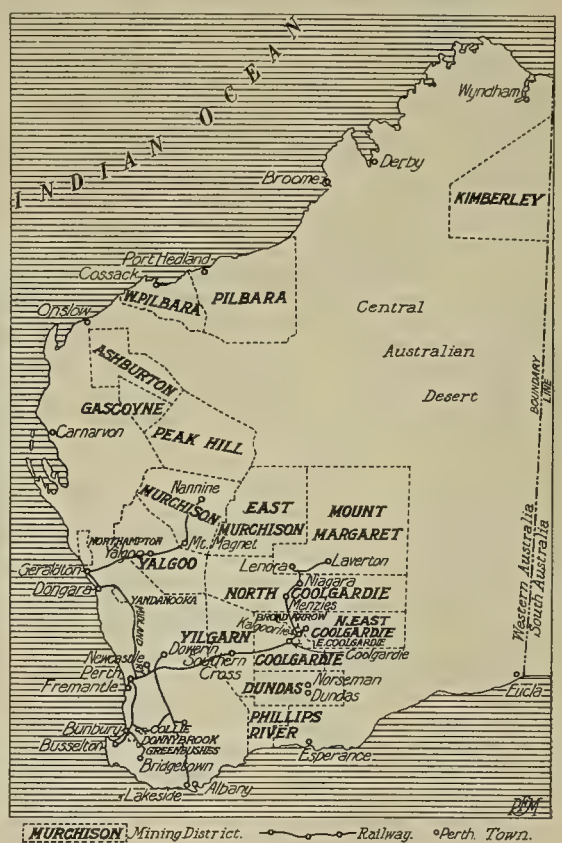
The next largest producer of tin in Cornwall, the Carn Brea & Tincroft, Ltd., has not been able to meet expenses during the year 1908. The results for the second half of the year show a production of 518 tons of concentrate from 34,790 tons of ore, that being a decided increase over anything yet done during the life of the present company. The produce per ton was 33 lb., as compared with 40½ at Dolcoath, and the average price obtained was rather less, owing to the ores not being so clean as those at Dolcoath. The receipts were £38,397, and working expenses £39,027. The lord's dues were £1388, and the net loss was £2018. This was a smaller loss than during the first half of 1908, when there was an adverse balance of over £6000. This company produces also wolfram, arsenic, and copper—a complex ore. For some years the directors have been aware that the mine and the dressing plant require a thorough overhauling such as is being effected at East Pool, but the time for raising new capital is not yet.

KALGOORLIE, WESTERN AUSTRALIA.

December Output.—Small Rich Mines. — Deep Developments in Golden Mile.—Metallurgical Methods.—Slime Agitation.

December returns from the principal mines at Kalgoorlie were as under:

Name.	Tonnage.	Value of output.	Profit.	Dividend.
Associated	10,886	$111,000	$21,000	
Associated Northern Blocks	3,730	38,000	14,000	
Golden Horseshoe	23,634	275,000	100,000	$375,000
Golden Link	3,600	31,000	—300*	
Golden Ridge	2,103	26,000	13,000	35,000
Gt. Boulder Proprietary	16,306	249,000	129,000	325,000
Gt. Boulder Perseverance	17,363	150,000	47,000	
Great Fingall	9,740	60,000	5,000	
Hainault	5,858	32,500	4,000	
Ivanhoe	19,590	215,000	105,000	
Kalgurli	10,160	140,000	75,000	
Kalgurli South	9,031	61,500	12,000	
Lake View Consols	7,732	55,000	15,000	
Oroya-Brownhill	11,560	80,000	23,000	
Oroya-Black Range	4,474	55,000	20,000	75,000
Sons of Gwalia	13,432	95,000	32,000	60,000
Sons of Gwalia South	1,900	22,500	4,800	



Western Australia.

*Loss. The Lake View Consols owns four-sevenths of this mine at present, and the ore is carted a distance of two miles and treated at the mill belonging to the power company.

During the month several rich mill-runs were reported from small mines in different parts of the State. A mine at Waverley yielded 1350 oz. gold from 18 tons of ore, and others were Boorava, 400 oz. from 8 tons, the Black Jack at Yalaginda, 580 from 8, Union Jack at Yuckanana, 281 from 62, and Nemesis, at Yuckanana, 211 from 30. The ore from

the first-named was a green talcose schist, with very fine regular lines of gold running through it, making the specimens exhibited uncommonly pretty to look at. There have been some good developments at depth in the Kalgurli, South Kalgurli, and Perseverance. The ore at 1900 ft. in the Lake View Consols appears to be low-grade; the shares are dropping back nearer their proper value. As a London journal remarked, it was absurd for the market valuation of the mine to raise $1,000,000 on the strength of cutting $250 worth of ore.

The broken crank-shaft at the Great Boulder main hoist has been replaced by a new one, and everything is in full swing again. The Associated has just completed erecting a large surface condenser to take the exhaust steam from all its engines. This condenser was made by Thompson, of Castlemaine, Victoria. There is a centrifugal pump driven by an Allen high-speed engine for circulating the water, and also a large 3-cylinder air-pump. The hot water is pumped to a large cooling tower of the usual type. The Horseshoe is putting in another A. E. G. turbo-generator of 500 kw. capacity. For many years past the Hainault Co. has been selling its concentrate to a local treatment company; but now that it has erected an Edwards tilting furnace, all the work will be done on the mine. The general mode of treatment of concentrate on this field is to roast in an Edwards or Merton furnace, mix with KCN, classify roughly in pointed boxes, grind the coarse portion to slime, and amalgamate the coarse gold in pans. All the slime is agitated, and finally treated in a filter-press with good results. On a few of the remote mines the raw concentrate is dumped into vats, and given a long treatment—even as long as three weeks—with KCN; but the residue is generally high enough in gold content for further treatment after weathering. The Hainault system of treatment is as follows: crushing in Blake crusher, feeding the ore from the bin upon two wide picking-belts (this is the only mine on the 'Golden Mile' that goes in for sorting, the waste being about 9%), which in turn feed two small jaw-crushers; the product is elevated by belt to the battery bins; 40 head of stamps fed by Challenge feeders crush the ore through coarse screens, the pulp going to 6 pans of the Middleton-Cable type. This pan is different to the ordinary kind, in that the muller cannot be raised or lowered when in motion, but the dies are forced up against the shoes by a suitable gear and compensating weights outside the pan; thus uniform pressure is maintained in grinding irrespective of the thickness of the shoes. The pans grind coarsely, as any mesh desired may be fitted on to the side of the pan. The pulp from them runs over Wilfley tables, and from these it is pumped to settling or collecting vats, the sand settling, and the slime going to agitators to be finally treated in two filter-presses of 5-ton capacity each. The sand is elevated by belt to a number of small vats for usual treatment. A good deal has been written of late on agitation in high-tanks, under the names of the Brown, Pachuca, and others. In this field there are three systems of agitation, namely, the ordinary vat with gear-driven spindle and arms attached; the A. Z. agitator; and the type used at the Kalgurli mine. The first named has its faults, but is generally in use. In vats about 22 by 6 ft., the horse-power required is from 2 to 3, and agitation must continue from 12 to 20 hours. The cost per ton, including power, KCN, wages, and repairs, will reach 35c. As far as results by the A. Z. agitator go, the horse-power required is 11, time 1 to 4 hr., and costs about 30c. per ton. It is the Kalgurli system that I wish to emphasize, as a patent was granted to Brown, of New Zealand, for a combination of a tank from 35 to 55 ft. high by 10 to 13 ft. diam., with an air-lift in the centre. This agitator appears to be working with success, although an informant at Waihi states that the air-lift has been dispensed with at their Victoria mill, the results being equally good without it. For about 9 years the agitation of slime at the Kalgurli mine has been done in tanks 12 ft. 6 in. by 6 ft. diam., with vertical sides for 7 ft. 6 in., then tapering for 5 ft., the bottom being flat and 18 in. diam. By means of two 1-in. air-pipes running to the bottom of the tank, the charge of slime is agitated. Formerly these tanks were covered, but in the enlarged mill the 20 tanks are uncovered, so that agitation may be observed. There is no air-lift in the centre. With 30 lb. air-pressure, agitation of roasted sulpho-telluride ore is continued for 4 hr. with over 90% extraction. The tanks are sunk in the ground to within 2 ft. of the top, and the man in charge has the whole lot under his observation. Each tank holds about one 5-ton press of dry slime, and is connected with the press-filling pumps by a 4-in. pipe. The costs of agitation by this method are 20c. per ton, air 6c., KCN 10, wages and maintenance 4. Water consumption during the past month at the Kalgoorlie mines was 30,841,000 gal., for about 140,000 tons of ore treated. The last 10 days of 1908 averaged 108° F. in the shade.

NEW YORK.

Metal Stocks.—Market Manipulated from London.—Shannon Copper Railroad.—Electric Steel Furnaces.

The course of the stock market, which for the past four months was fairly steady, the variations being within about 3 points, was suddenly changed on February 23, when a severe decline was experienced. A raid was made on the metal stocks, which declined from 10 to 15 points. It was evident that the raid was exceptionally well planned and executed. The storm centre circled around United States Steel stocks, which were driven from 52½ to 41½. The raid was started from London, where J. P. Morgan, William Rockefeller, and James Stillman appeared to be active. As soon as the New York Exchange opened, enormous selling orders were executed from London, which brought prices crashing downward like a house of cards. Most margins were wiped out within the first three hours. On the following day prices recovered from 2 to 3 points. On February 25 the copper stocks were subjected to a second raid, which carried the general market a few points lower. Large buying orders were then sent in by the pool managers, and it is probable that a Taft inaugural demonstration will be made, which will run prices up again close to those ruling before the raiding. The raiders were so successful that there is little doubt the operation will be repeated at no distant date. Those most interested in the raids are also largely interested in the copper trust, and there is a possibility that the trust will be operated in a similar manner to the United States Steel and Amalgamated Copper corporations. Experience has shown that larger and quicker returns are obtainable by operations on the Stock Exchange than at the smelters. That fact was learned in the early days of the Standard Oil Company. The directors of that concern keep a large part of their surplus income active in Wall Street.

The directors of the Shannon Copper Co., Arizona, have decided to carry out extensive improvements. In order to save the freight paid to the Arizona Copper Co., a railroad will be built at a cost of $500,000 to connect the mines with the mill and smelter. A separate company will be formed and underwritten by four of the directors, and then debentures will be issued to the public. When this plan is carried out, the Shannon Copper Co., like the Amalgamated with its U. S. Metals Selling Co., will carry a little old man of the sea on its back.

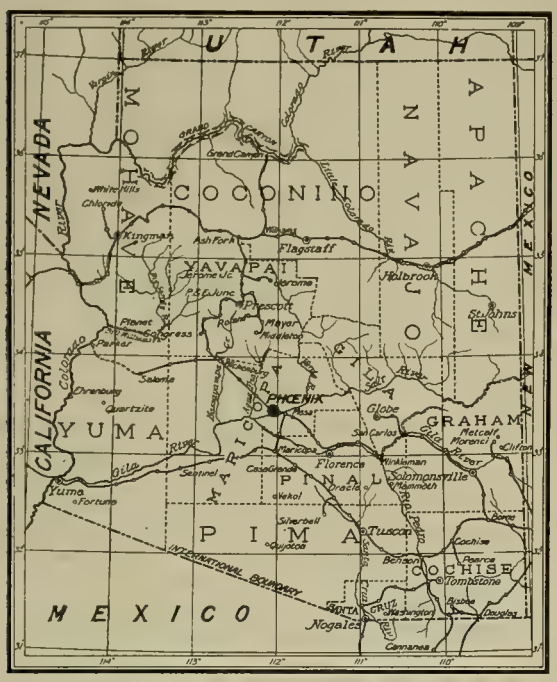
The Tennessee Copper Company produced 14,464,585 lb. copper in 1908. This was the largest output in the company's history. The profits for the year, as shown by the annual report, amounted to $354,768. A sum of $50,000 was set aside for depreciation on plant. The cost of producing and marketing electrolytic copper amounts to 10c. per pound.

During the past seven years the electric furnace has been extensively employed in European steel works, particularly in Italy and Germany. Excepting the experiments in reducing iron ore made in a Heroult furnace in California, little has been done in electric smelting in the United States. It is probable, however, that conditions will soon change, as it is reported that the United States Steel Corporation has

purchased the Heroult patents and will equip several of its works with electric smelters.

The 12 smelters which the American Smelting & Refining Co. operates and owns in fee simple have a capacity of 4,365,300 tons of ore, whereas the actual amount smelted has averaged 3,500,000 tons annually. The company makes this matter public to the New York Stock Exchange in its application, which has been granted, to place in the listed department $50,000,000 each of common and preferred stock, which heretofore have been in the unlisted department.

The company owns two refineries, that at Chicago having a capacity of 84,000 tons of refined lead and 16,400,000 oz. refined silver and gold, and the Perth Amboy plant, having the capacity to handle each year 66,000 tons of refined lead and refined copper each and 36,000,000 oz. refined silver and gold.



Map of Arizona Showing Position of Cananea.

In detail the smelters are:

	Capacity, Tons.	Furnaces, Number.
Globe, Colorado	322,000	7
Pueblo, Colorado	328,000	7
Eilers, Colorado	295,000	6
Durango, Colorado	146,000	4
Arkansas Valley, Colorado	509,000	10
Murray, Utah	523,000	8
East Helena, Montana	235,000	4
Monterrey, Mexico	460,000	10
Aguascalientes, Mexico	720,000	10
Chihuahua, Mexico	153,000	3
National, Illinois	60,000	2
Perth Amboy, New Jersey	140,000	3

The Company also owns the Grant plant, which is within the city limits of Denver and stands on 120 acres of land, but this is not being operated and has been practically dismantled.

Aside from these plants, which are directly owned and operated by the American Smelting & Refining Co., there are a number of other plants operated by subsidiary concerns. For instance, the Consolidated Kansas City Smelting & Refining Co., every share of which stock is owned by the American Smelting Co., owns and operates a smelting plant at El Paso, Texas. This covers 1500 acres and has a capacity for treating 492,000 tons annually in its 10 furnaces.

At Omaha the Company operates a smelter and refinery upon a leasehold running for 18 years from this time. The smelter has two furnaces with 82,000 tons annual smelting capacity while the refinery can treat 156,000 tons of refined lead a year and 36,000,000 oz. refined silver and gold. The copper converting plant has a yearly capacity of 12,000 tons of blister copper. The Company approximates the value of its smelter's product at $70,000,000 a year. The annual refineries product is as follows:

Gold	1,250,000 oz.
Silver	66,000,000 oz.
Copper	66,000 tons.
Lead	225,000 tons.

The total value of refined metals sold annually by the Company approximates $97,000,000. The Company owns and operates in Mexico ten mines, five of which at Sierra Mojada, Chihuahua, have an annual output of 33,000 tons; four at Santa Eulalia in the same State, with an annual output of 60,000 tons, and one at Asientos, State of Aguascalientes, with an annual output of 72,000 tons.

According to estimates just made, the decline in the market value of 35 listed copper stocks aggregates $135,000,000 as compared to the highest prices in 1908. There has been a drop of over $30,000,000 in Amalgamated alone, $8,500,000 in Butte Coalition, $8,000,000 in Calumet & Hecla, and $9,400,000 in North Butte shares.

CANANEA, MEXICO.

Copper Production.—Metallurgical Operations.—Centralizing Power.

The copper production of the Cananea Consolidated Copper Co. for the month of January was 3,800,000 lb., and the production in February was practically the same, as the daily output has been averaging 67½ tons. The mines, including the lime and iron quarries, are delivering to the concentrating and spreading beds about 3400 tons of flux and ore daily. Of this amount over 500 tons of lime and iron are used in the mixture, the remainder being first and second-class ore.

The Oversight mine is by far the largest producer, with a daily output of 930 tons. The output of the other mines of the company is about as follows: Veta No. 5, 580 tons; Elisa, 365; Duluth, 285; America, 270; Capote, 180; Puertocito, 170; Kirk, 50 tons. Early in January work was resumed in the Kirk mine, which has been closed since before the general shut-down over a year ago. The known orebodies in this mine are small, but the ore is of good grade and metallurgical character, averaging higher than 7% copper and 30 to 35% each in iron and sulphur, and is low in silica. Comparatively little development has been done. There is a large slightly mineralized area, and the representatives of the U. S. Geological Survey who made a careful study of the company's holdings 18 months ago think the Kirk mine one of the most promising in the district. Operations for ore-production have also been resumed at the Capote. Of the new development in the mines, the most important is the driving of two long tunnels, one in conjunction with the Phelps Dodge Co., developing the ground of both companies. This tunnel is being run from above Chivatera toward the Elisa mine, and the other from the head of the Democrata gulch in a southeasterly direction under a heavily iron-stained country, the hills rising abruptly from the mouth of the tunnel. This latter tunnel has already cut for some distance ore carrying 2% copper. At the reduction works are six blast-furnaces, a reverberatory furnace, and two converters in operation. The average daily charge of the blast-furnaces, exclusive of coke, for the month of February has been about 2250 tons. The reverberatory is handling 190 tons of the flue-dust daily. The McDougal roasters are at present shut-down, there being sufficient flue-dust from the six furnaces to supply the reverberatory. Construction work on the furnaces is complete, eight being in readiness. A matte-pit is being constructed at one side of the spreading beds. This pit is to be used for the reverberatory matte, which will be reclaimed by a steam-shovel and sent to the blast-furnaces instead of directly to the converters, as is done at present.

The object of this change is to increase the matte-fall in the furnaces.

For several months Mr. Langton, formerly mechanical engineer for the Phelps Dodge interests, has been in Cananea working on the problem of centralized power-production. The plans are as yet incomplete, but a compressor with a capacity of 6000 ft. of free air has been ordered. This compressor will be installed at the main power-house and air will be piped to a number of the mines. It is planned to use air for the Duluth, America, and Capote hoists. Air for the drills in the various mines will also be compressed at the central power-plant. The air will be re-heated at the terminals.

There are electric hoists operating at the Elisa and Kirk shafts, and recently an electric pump has been installed at the Duluth mine, the electric power being produced at the main power-house. Gradually the power-production for the entire property will be centralized. The use of fuel oil has been extended to the Veta No. 9 and Capote boilers, effecting a saving of from $150 to $200 per day. The waste heat from the reverberatory furnace produces about 600 hp., which, together with the larger tonnage smelted since the change to oil, adds another item to the many improvements constantly being made.

SALT LAKE, UTAH.

Ray Consolidated Development.—Option on Tintic Mines and Smelter.—Smelter in Pine Canyon. — New Railroad to Ely. — Fink Process.—Boston Consolidated.

D. C. Jackling, general manager of the Ray Consolidated copper properties in Arizona, has just returned from a two weeks' visit to the mines. He says the officials in charge have 350 men employed opening up the properties, and plans are being laid for a mill and smelter. They also have an engineering force selecting a route for the railroad to connect the mines with the plants. The drills are proving the continuation of the orebodies, and Superintendent Wiseman reports that they have the assurance of a 2% body of copper ore sufficient to keep a mill of 3000-ton capacity busy for years. The men controlling the Utah Copper Co., together with English capitalists, dominate the new enterprise. Mr. Jackling says they will show as large profits in the operation of these mines as are now being made by the Utah Copper.

Options recently obtained on the Colorado mine and the Tintic smelter, at Tintic, call for the payment of $4,000,000 for the mine and $1,200,000 for the smelter. The mine has already paid $1,225,000 in dividends, and is regarded as one of the richest silver-lead properties in Utah. The smelter has only recently been built and placed in commission. Three lead furnaces, with a daily capacity of 225 tons each, are in blast, while a copper furnace and a fourth lead furnace are ready to blow in at any time. Both the mine and smelter are controlled by the Jesse Knight syndicate, which has had a most successful career. The option was obtained in the interest of the Cole-Ryan syndicate, and an examination of the mine is to be conducted by their engineers within a few days. It is understood that they are desirous of obtaining a good silver-lead property in this State, but they do not seem disposed to take over the smelting plant. They have almost completed arrangements for building works for the International Refining & Smelting Co. in Pine canyon. Surveys have just been completed for an ore-hauling railroad to connect that point with Deep Creek and Ely. The surveys show the length of the proposed line to be approximately 250 miles, and it is understood that this would eliminate the possibilities of the International Smelting & Refining Co. building a smelter near Ely for the treatment of the Giroux Consolidated and custom ores. This line would haul the ores from Ely and Deep Creek to the Pine canyon plant, and it is intimated that the Cole-Ryan people will take an active part in having this road constructed in the shortest possible time. The Pine canyon smelter will be ready to receive ores within a year, according to a statement by the smelter officials at this point. The spur line from the Salt Lake route to the smelter and Tooele City, which will be 6½ miles long, will be completed by May. As much of the structural steel and some of the equipment will soon be started from the East, E. P. Mathewson, manager of the smelter, says they will have everything in readiness to complete construction earlier than was at first planned.

During February, 5,023,181 shares of mining stock were dealt in on the Salt Lake Exchange. In a single week of the past month more shares were transferred than for the entire month of February of last year. Edward Fink, the inventor of the smelter which has produced blister copper direct by one process from the Boston Consolidated concentrate, announces that all necessary alterations have been made for the run with oil as a fuel, and that the plant will be placed regularly in commission within a few days.

Sidney J. Jennings, who was elected director and member of the executive committee at the last annual meeting of the Boston Consolidated shareholders, is out from the East. Mr. Jennings is consulting engineer to the company, and will spend some time inspecting the properties at Bingham, and the milling plant at Garfield. Steam-shovels will again be placed in commission at the Boston Con. mines. After the overburden has been removed, the company will be in position to keep its mill supplied to the full capacity of 3000 tons daily from its porphyry ores. About 1500 tons are being mined daily from the sulphide deposits of the company, and it may be autumn before the entire property can be placed in position to produce heavily from both the sulphide and porphyry deposits.

MEXICO.

Greene Concession Forfeited. — Cole-Ryan Interests in Western Chihuahua.—Loaning Money for Mine Development.

On February 9 the immense section in western Chihuahua on which W. C. Greene had a concession of a zone of exploration, was declared forfeited and thrown open to denouncement, or location. It was generally supposed that there would be a rush of denouncements, as during the life of the concession there has been continual talk of great finds being made within the zone. For some reason, however, the denouncements are still being held up—probably because, as is usual in such cases, the non-attainable is always the richest. Now that it is attainable it is not proving up so well. It was thought for a while that the throwing open of this zone, which was delayed for a month, would be restrained in some way by the Cole-Ryan people, who have acquired certain of the Greene interests in western Chihuahua. But apparently they made no effort to do so, and just what their program may be for that portion of the Greene properties they have taken over is not known, nor is it definitely known whether they have interested themselves in more than the lumber lands held by the Sierra Land & Lumber Co., which is also one of the Greene companies.

Considerable hope is being held out to the Mexican miner by the Consolidated Metals Co., of Mexico City, which is offering to advance money on mines that will stand examination. This should be a boon to those who lack means to put the properties on a productive basis. The Consolidated Metals Co. was primarily an ore-buying company, and is intimately associated with the Vogelsteins, the United States Smelting, and others, which comprises a group of miners, ore buyers, smelters, and metal sellers, appearing as complicated to the outsider as the A. S. & R. Co., the Guggenheim Exploration Co., M. Guggenheim's Sons, and the American Smelters Securities Co.; but the Consolidated Metals has within the past year become so involved in Mexico, particularly in Oaxaca, that it is now difficult to say whether the principal interests are ore buying, mining, or railroading. This latest move, however, of loaning money to the worthy miner, if properly carried out and with fair conditions to the borrower, should prove of benefit to all concerned.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

The grade of the Miocene ditch, 40 miles in length, is 3.37 ft. per mile for the portion that runs through frozen ground. The ditch is 14 ft. on the bottom with a slope of 1 to 1.

Huntington mill work on gold ores is best conducted without the addition of mercury inside. The losses of amalgam are greater than any compensating advantage, and 'float' amalgam is exceedingly difficult to arrest, as all mill-men know.

The only important gold-vein mine in northern Alaska is the Big Hurrah, near Solomon, on the Seward Peninsula. This mine was operated by Charles D. Lane, but it is now idle. The gold occurs in veins of quartz traversing graphitic schist. The graphite is said to have hindered amalgamation in the mill.

Gold mines as investments fall within a class of rapidly wasting assets. It is sometimes possible to make an approximate estimate of the period when the deposit will have been exhausted and the operations of the concern will have ceased. Mining investments, therefore, differ radically from those in railroads or industrial enterprises, which can usually be counted on, for the purposes of an investor, to last indefinitely.

Sodium sulphate, or Glauber salt, occurs widely disseminated throughout the desert regions of the Western States. It is precipitated in large quantities in winter from the waters of the Great Salt Lake, Utah, and is washed upon the shore, forming masses several feet in thickness. There is practically no market for sodium sulphate, the available deposits being so many and the uses few. The refined salt is worth about $6 per ton at tide-water.

Gabbro is a granular igneous rock consisting chiefly of pyroxene and feldspars, the pyroxene being as abundant as the feldspars. Olivine is a common accessory. The color is usually dark gray or greenish, to black. It is a basic rock, containing about 50% SiO_2. Gabbros are frequently found in the form of schists, resulting from pressure. Iron is frequent in gabbros, magnetite and titaniferous ores prevailing. Sulphides of copper are also associated with these rocks in many parts of the world.

Gold veins of importance are rare in mica schist; on the other hand, the gold-bearing quartz stringers through schist have for the most part been responsible for the great placer deposits of the world. In many schistose regions, however, veins of workable size are occasionally found, such as those of the California gold-belt. The common characteristic of quartz-veins in schist is that, being of the 'cementation' type, they lack persistence and uniform mineralization. Spaces of discission which had subsequently been filled by cementation quartz, are associated usually in zones, so that cross-cutting is needed to reveal new veins. The amount of dead-work is accordingly relatively large. As an off-set to the disadvantages the gold is usually readily amalgamable, and high recovery by relatively inexpensive methods is feasible.

The North Star mine at Grass Valley, California, has reached a depth of 5400 ft. on the dip (28°) of the vein or 2086 ft. vertical. According to Mr. Arthur DeW. Foote, the manager, the vein is larger and shows more gouge at the bottom than on the upper levels. The ore remains as rich. The walls of the vein are farther apart and the quartz is generally in layers or stringers with country rock between, so that of the 6 ft. sent to the mill fully 60% is waste, reducing the average yield to $12 per ton. On the upper levels the mine averaged 18 inches of $18 ore. The reserves of ore above the 4000-ft. level are ample for several years; no stoping is in progress below 4000 ft., although the ground is being tested by means of levels and raises. After the vein has been once drained, the water, below the 2000-ft. level, amounts to only 250 gal. per minute and does not vary with the seasons. Above 2000 ft. the rainfall is felt quickly and in spite of careful surface drainage the seepage underground is from 600 to 800 gal. per minute at the present (January) time. The mine workings now cover an area ½ mile by ¾ mile, but no ore-shoots are defined, there being no evidence of discontinuity in the distribution of ore.

The weight of gold in a quartz specimen can be closely approximated, if there be no admixture of pyrite or other foreign material, by a specific gravity method. Let

A = specific gravity of the gold.
B = specific gravity of the quartz.
C = specific gravity of the specimen.
x = weight of the gold.
y = weight of the quartz.
W = weight of the specimen.

Then $$\frac{x}{A} + \frac{y}{B} = \frac{W}{C}$$

and $$xA + yB = WC$$

If now the values for the specific gravities of gold (19.25) and quartz (2.65) be substituted, these equations reduce to

$$x = \frac{W}{18.9}\left(C - \frac{7}{C}\right)$$

which gives in a simple expression the weight of pure gold in the specimen. It must be remembered that the specific gravity of both gold and quartz may be different from the values given, owing to silver alloy in the gold, and to variations in the density of the quartz, so they should be determined independently when it is intended to accurately estimate the quantity of gold. In a similar way the ratio between the weights of two minerals, such as galena and sphalerite, can be found, when they contain no other substance intermixed.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

American Institute.

The Editor:

Sir—I wish to thank you most cordially for your recent editorial on the nominations for officers of the A. I. M. E. I think you have done a real service to the Institute, and to the mining and metallurgical professions. Your objections to Mr. Ralston are pithily and fearlessly expressed, and do not, in the slightest degree, reflect any discredit on him; in fact, I think they imply that his nomination was due to his individual prominence. The point you raise, that he cannot be recognized as a representative of the mining and metallurgical professions, is timely and sound. Your characterization of the membership of the A. I. M. E. is strictly true. I wish you would follow up the matter and show that this is not necessarily a defect in its organization. I think it should be made the greatest element of its strength. There is a positive demand for a voluntary association of all those who are either directly or proximately connected with the mining and metallurgical industries. The founders of the Institute showed their faith in this idea by welcoming everyone who chose to join them, so long as he was a worthy member of society and was pursuing the objects for which the Institution was formed. There never has been any claim for equality, either in natural gifts or attainments, made among the members. It is recognized that a boy throwing by hand the valve of a pumping engine might develop into a man of the highest rank. But the heterogeneity of the membership of the Institute requires a unity of spirit. Your point is, that we should choose representative men, and in the case of a professional society, they should be professional men. With the growth of our nation every institution of national importance must develop a proportionate growth, or be atrophied. Believing as I do, that the exercise of Federal powers was wisely restricted within State boundaries by the constitution, I think the effective agents of national progress are voluntary associations of individuals actuated by a common spirit, working for a common object, not entirely selfish, but tending to the common welfare. The profession of medicine and surgery gives an illustration to the point. Their city, county, State, and national organizations are all united by a single idea: the development of the dignity and usefulness of the profession. The associations of lawyers have also the same objects, and their combined influence is noteworthy. These various associations, of medical men, scientists, lawyers, bankers, business men, and others, are co-extensive in their special fields, and should not interfere with each other's functions. They are like different systems of branching nerves, each affecting and directing their own congeries of vital processes in the body politic. Between them there must be established a certain comity. Just as there is needed a predominent directive force in each functional organism, so there is needed some control, by which they can act without interfering with each other's action. Therefore, just in proportion as the membership of the Institute is made general, so should its actuating spirit be made evident; and the rules of behavior and practice, which have been found essential in the development of civilization, be carefully followed.

To cite a single case, I think the discussion by the Institute at the recent meeting, or even the reading of a paper, on a sea-level canal at Panama, ill advised. In the Institute there are many prominent civil engineers, entirely qualified to discuss this question; probably all of them are members of the American Society of Civil Engineers, to whose province this problem of construction belongs. It appears to me to show a lack of courtesy for mining engineers and metallurgists thus to invade the field of an equally national society. If the question concerned the effect on the mining industry of a sea-level, rather than a lock canal, it would be quite within our own domain. I go further and say, the time chosen for the discussion is inopportune. A canal is conceded to be a commercial and military necessity. The plan has been decided upon, the work is rapidly progressing. Doubtless it will be worth all it will cost. The first trans-continental railroad furnishes a parallel instance. It was a means of communication thought, by those who were responsible for the preservation of the union, to be of vital importance to the continuance of the national life. It was a heroic achievement, and was paid for by a nation. The money-cost of such public services, in emergencies, cannot be scrutinized like ordinary transactions of business. The time for such a discussion was years ago.

I hope you will continue to exert your influence to sustain and uplift the professional tone of the Institute, and bring the national engineering societies into closer relations.

F. L. CLERC.

Denver, February 17.

Protection of Investors.

The Editor:

Sir—I have read with much interest the discussion entitled 'Protection of Investors', in the columns of your most recent issues, and although I feel that I am not able to give information necessary to overcome the existing evils, practised by the mining engineers, mine managers, promoters, and investors in mines and mining stock, yet I do think that I have had in practice for two years a remedy, which, if adopted by all mining engineers, will largely overcome the troubles that exist, and will be of some protection to the new investor. I do not believe, however, that such practice will be adopted by the mining engineers or mine managers, owing to the fact that it would inflict an injury to a great many of those who have already invested, also upon the mining engineer who may adopt this practice, as it has done to the writer.

When I opened my office at Seattle in 1906 I carried a card in a certain mining journal, openly stating that I would furnish a sworn affidavit with my reports. Today I am only able to show a copy of one report, written for an individual owner who had a property for sale. This property was a bonanza, hence the reason for his desiring a sworn affidavit with the report.

For the last eighteen months my only examinations have been for individual stockholders who have had their legs well pulled from time to time, and desired to know whether or not it was best to drop their assessment and lose all, or go ahead and put in more money. And for each and every report I have written for stockholders, I have had sums offered me, by the promoter, far exceeding the fee charged the stockholder for my examination, to report favorably. This fee was usually payable in stock.

It is still a question in my mind as to whether this remedy will overcome the existing evils or not, but it seems to me that if adopted by all mining engineers it would greatly help. Of course, the mining engineer who furnishes a sworn affidavit with his report can only state that to the best of his belief same is true; and even though he could not be held for perjury, if same were not true, it should have a strong tendency to curb the engineer who is too apt to say there are millions in sight when writing a report on a developed or undeveloped property for the dishonest promoter, who, on his side, is always ready to offer a handsome fee in the way of stock for a flattering report.

JAMES H. FOX.

Vancouver, B. C., February 8.

California State Mining Bureau.

The Editor:

Sir—In your issue of February 6 appeared an article from the pen of J. M. Hyde, attacking the State Mining Bureau and its management, and following along the lines of previous attacks made by your journal on the Bureau and myself. So that your readers can more thoroughly understand the motives underlying these attacks, it should be said that the discharge, removal of, or resignations demanded by me of different employees, caused the untruthful and unwarranted abuse. Mr. Hyde can be classed with the discharged employee, and the employers of labor know what that means.

In his remarks, Mr. Hyde voices the same cry as the Editor: that the Bureau is controlled by Southern Pacific influences, and that I have aided the latter in fighting the Western Pacific. Now, I want to suggest to all the soreheads that if they are going to lie in the endeavor to gain their points, that they lie with reason. Neither the State Mining Bureau nor myself has ever raised a hand against the Western Pacific. My efforts were directed against H. H. Yard, and as Mr. Yard will agree, and as he stated numbers of times, he had no connection with the Western Pacific, for did he not form the dummy North California Mining Co. in 1902, for the purpose of locating with placer locations the 265,000 acres of timber land in Butte and Plumas counties, which I characterized as a big steal, and which was reported by me to the Government on November 7, 1902. Further, did not Mr. Yard organize the Butte & Plumas Railway Co., with the following directors: H. H. Yard, E. H. Benjamin, A. M. Hunt, A. Ekman, and Carlton Gray, and did not Curtis Lindley appear as attorney for H. H. Yard and this railway when the articles of incorporation were filed on October 13, 1902?

Perhaps this little untold history may not generally be known, but the records of the Secretary of State will bear me out, as will also the press of the State of California; therefore, if the Western Pacific was masquerading behind Yard or the companies mentioned, their identity was unknown at the time of my attack. The blow that was given Yard by the United States Land Office decisions condemning his placer mineral locations as invalid, and that they were made to secure the timber upon them, would also appear to have inspired some of the animus exhibited to me.

Speaking of these influences, Mr. Hyde's inconsistency is ridiculous. In one breath, he says that the Southern Pacific directs all the affairs of the Bureau; in another, he admits that he was asked by me to take the appointment as Curator, and for once he has told the truth, as the latter statement is correct. He could, if he wished, also state that he knew of other appointments which were made without the necessity of a political pull, and which were made on trial, subject to the employee showing that he was capable of "holding down his job." Mr. Hyde was given a like opportunity, but he occupied too much time in theorizing, with the result that nothing was accomplished in the Museum.

He then concluded that he was cut out for the position of Field Assistant, and in order to give him an opportunity of proving his ability, he was appointed to this position, and sent into the field, with the necessary equipment, and directed to secure samples of oil for analyses from the different oil-fields of California. He carried a letter of instructions to sample all oils direct from the pump at the wells. Out of about seventy samples obtained, three were taken according to directions. The balance were obtained from sump-holes and tanks where the oil had been exposed to the sun from one to six months. Yet this savant, with his head swelled out of all proportion by the sense of his own importance, concluded that his ideas were so far superior to those of his chief, that it made no difference how or where the samples were obtained. After his recall to the city, and notwithstanding his direct disobedience of orders, he insisted on the State giving him a two weeks vacation at Lake Tahoe. I have seen several exhibitions of 'nerve', but this capped the climax, and Mr. Hyde was told that he would be given a vacation, and a long one at that.

It was then that he rushed into print with his troubles, but instead of convincing anyone that he was the only man on earth who was gifted with administrative ability, he showed himself to be the sneaking ingrate that he is—and one unworthy of the confidence of any employer. The Board of Trus-

tees investigated Mr. Hyde and his charges, which were found to be entirely without foundation. However, as I remember, the Board censured me (and I admit the justice of it) that in future selections of employees, I should exercise better judgment, and demand proper endorsements as to ability, and not appoint them (as was done in the case of Hyde) on their own estimate of their ability.

As to the employment of a relative, there was no reason why I should not employ him. He was engaged to do the work properly of collecting oil samples which Hyde was not capable of doing, and as to ability, said relative had been mining for twenty years before said Hyde had commenced the A.B.C.'s of a theoretical education.

The statements of Hyde in relation to the Copper bulletin are lies made out of whole cloth. The bulletin will testify for itself. Due credit was given to everyone connected with it, with exception, possibly, of the men who set the type, the proof-reader, and the boy who oiled the press. I unintentionally forgot to mention in my letter of transmittal that Mr. Hyde may have assisted the janitor in carrying some of the Copper bulletins upstairs when the printer delivered them, but I could hardly anticipate what he would do.

The statements made by Hyde in relation to the bulletin on Saline Deposits also characterizes him as a member of the Ananias Club. In this bulletin, as well as all others, no individual's mining property, or that of any corporation, is boomed, no favorites are played, and nitre deposits, owned by different persons, were treated alike. The same system is used in the bulletins as was used in reports issued by my predecessors.

Again the bulletin speaks for itself to unprejudiced readers. If Professor Bailey named a lake after me, because, as he asserts, it was through my instrumentality that the desert section of the State was brought into prominence, he is to blame for that, as he will admit. I do not know that I have felt particularly flattered at the honor conferred, as this lake was a 'dead one'. I might say right here that with all Mr. Hyde's and my other enemies' endeavors to 'knock', before I am through with them, they will find that I am very much alive.

Of course, the learned (?) theorists know how much better the Bureau could be conducted if one of them was in charge. Perhaps the disappointed ambitions of Mr. Hyde and a few others to become State Mineralogist might also be ascribed to some of this gnashing of teeth. My enemies advocate a better administration, yet, if an employee fails to do his duty and is dropped from the payroll, a wail goes up from the clique whom I have fought and will continue to fight. This talk of having the interest of the Bureau and the mining industry of the State at heart is hypocritical bosh. I see the tears by the skip-load running down the faces of those who are so sorry to see the Bureau go to the demnition bow-wows, and I know that their feelings can only be allayed by the possibility of getting me out—or wrecking that which they cannot control. But their purpose is too apparent, and their work too raw, and if they think for a moment that I have "laid down the gloves," let all the sore-heads, discharged employees, timber thieves, mining fakers, the rag tag and the bob-tails come on. As usual, I will be found in my office attending to business.

Regretting, Mr. Editor, that I have taken so much of your space, and wasting printer's ink answering the slimy ooze which has called forth this letter, I remain,

L. E. Aubury.

San Francisco, February 19.

[The foregoing epistle needs but little comment; it testifies eloquently to the character of the man who officially represents the mining industry of California. We would have been justified in consigning this scurrilous screed to the waste-paper basket, but the publication of Mr. Hyde's letter made it proper to give equal prominence to Mr. Aubury's rejoinder. Only one further remark is called for: the Butte & Plumas Railway Co. was organized in the Gould, that is, Western Pacific, interest with a view to obtaining a strategic position by means of a right of way through the Beckwith pass. Also, the mining locations taken up by the North California Mining Co. were a blind intended to make the local people think that the project was a local enterprise independent of any trans-continental railroad schemes.—Editor.]

Agreement of Assays.

The Editor:

Sir—How close should two assays check with one another, or, to put it differently, what variation should be allowed between the smelter assay and the control, without calling in an umpire? Obviously, where one would be justified in calling for an umpire, if there was a difference of 0.05 oz. Au, in an ore assaying 0.20 oz. per ton, he would not be justified in so doing if the ore ran, say, $10 per ton. I think it would be well if some of our leading chemists and assayers would express themselves on this subject, and state how close they think two chemists should agree in reports on the metals and other substances reported in a smelter analysis, using the best technical methods. It would tend to give the profession a standard to work by, and would help to protect us from the layman, when we do not check exactly. I might state that at the 'Laboratorium Fresenius' in Wiesbaden, Germany, using methods of exact analysis, a difference of 0.3% on a basis of 100 is considered very good. This amounts to an error of three in one thousand.

E. R. Rice.

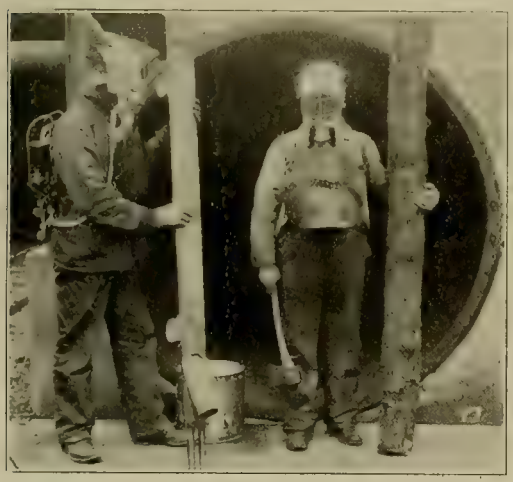
Wickenburg, Arizona, January 10.

Tin has been found in Northern Nigeria in Africa. Nigeria was constituted a British Protectorate in 1900. The tin deposits were discovered as a result of railway construction across the Bautchi highlands. These deposits have been favorably reported upon by W. G. Churchward of the firm of John Taylor & Sons of London.

RESCUE-WORK IN MINES.

At the United States mine-experiment station at Pittsburg, two discoveries have been made which will tend to decrease the number of deaths in mines. It has been demonstrated that a number of the so-called 'safety' explosives are unsafe; in fact, the statement is made that with the present explosives used in coal mining, the shot-firer takes his life in his hands every time he touches off a fuse. It is the purpose of the Government to continue these experiments until the explosives of the country are standardized in such a manner that the miner will have a definite knowledge of their qualities. A bulletin will soon be issued recommending as permissible explosives such as stand the test.

Important and far-reaching experiments have definitely shown that coal-dust is an explosive equally as dangerous as fire-damp. This has been a mooted question among mining engineers and miners, many



Members of Government Rescue Corps Equipped With Oxygen Helmets Ready to Enter Mine.

insisting that it is impossible to explode coal-dust unless there is gas present. That coal-dust will explode in a mine where there is no gas has been repeatedly shown to operators and miners at the testing station. The experts at the station are now endeavoring to discover some method by which this dust can be prevented from being a serious menace to the miners. Experiments in wetting it have been made, but nothing of a definite nature has as yet been learned, except that coal-dust does not ignite when there is a large amount of moisture in it.

The purpose is to approximate closely the conditions in a mine. Tests of dynamites and powders are made in a mammoth boiler-plate cylinder, previously filled with gas or coal-dust. The cylinder is 100 ft. long and 6 ft. diam. Safety valves have been placed along the top and are left unfastened in such a manner that when the explosion occurs the valves fly open on their hinges. A series of portholes on the side, covered with one-half inch glass, enables those conducting the experiments to witness the results from an observation house 60 ft. distant. Natural gas is used at the station for fire-damp, because it corresponds closely to that deadly gas.

These investigations are expected to obviate employing improper explosives, as well as the improper use of suitable explosives. The use of too high charges or of unnecessarily violent explosives, shatters much good coal, and converts fuel into dust which may itself be explosive and become productive of further damage. Such explosions also loosen the roof of a coal mine, which may fall later and produce fatal accidents.

In addition, important experiments are being made in rescue work. One part of the station has been fitted up as a miniature coal mine. This is a large glass-encased, air-tight room which contains difficult passages such as are found in coal mines. There are also various obstructions similar to what would be found in a mine after it had been wrecked by an explosion; also dummies weighing 150 to 200 lb., representing asphyxiated miners. This room is filled with deadly gas and a rescue corps of men in process of training for the work enter, clad in helmets which supply them with oxygen while they work. The men remain in this chamber for two hours, removing obstructions, picking up the dummies, placing them on stretchers, and carrying them away. There is also in the room a machine which records the amount of work a man may be expected to do while wearing one of these helmets. One-half of the large building in which this rescue-room is situated is used as an auditorium, and several hundred miners and operators have watched the rescue-drill through the large glass windows which separate the auditorium from the gas-filled chamber. Although there has been little opportunity for the rescue-corps to demonstrate its efficiency at the mines, it has nevertheless done some good work. Once the helmeted men, while fighting a mine fire, succeeded in bringing an unconscious man to a place of safety, where he was given oxygen-treatment and restored in a short time.

It is not the intention of the United States Government to furnish rescue-corps whenever there is a disaster. The present corps was organized with the idea of encouraging the mine owners and the miners to form such organizations. Invitations have been issued to operators throughout the country to send picked men to the experiment station, where they may watch the Government rescuers at work and later go through the same training themselves, in order that they may gain the necessary confidence in the use of these helmets. A number of the large mining companies are organizing rescue-corps at their mines, fully equipped with oxygen helmets.

In 1907, more than 3125 men were killed in the coal mines of the country—a death rate of 4.86 for every 1000 men employed. This is from three to four times as many men per thousand as are killed in any coal-producing country of Europe, where experimental stations such as the one at Pittsburg have been in operation for several years.

Chromite bricks should not contain more than 15% clay. With larger proportions the alumina renders the mixture more fusible than kaolin.

TRAVEL IN COLOMBIA.

Written for the MINING AND SCIENTIFIC PRESS
By COURTENAY DE KALB.

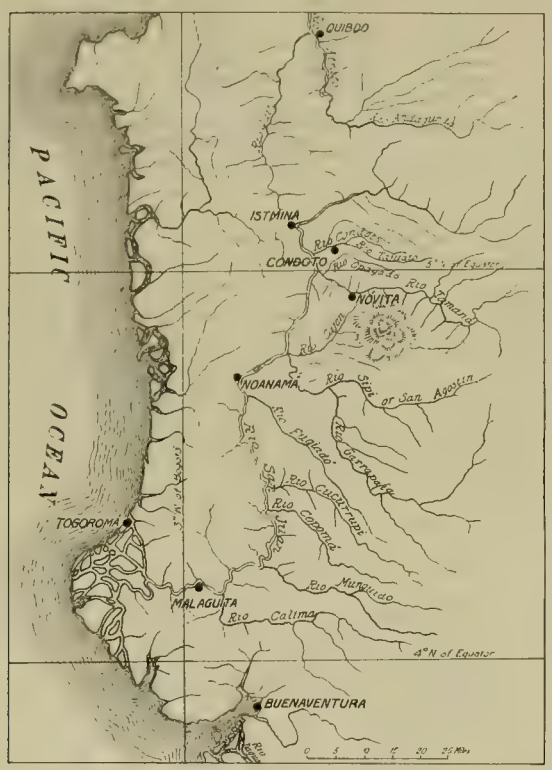
Some of the golden opportunity in Colombia has been pointed out in the MINING AND SCIENTIFIC PRESS by articles from the pens of F. F. Sharpless and F. Lynwood Garrison, and also by editorial comment. Colombia has remained an almost unknown land, although eminently accessible, because of political disturbances and the fear in which foreigners hold a tropical climate. Both causes are serious deterrents of enterprise. The political difficulties have been happily terminated through the confidence reposed in President Reyes. In fact, before his accession to the presidency peace had been established under President Marroquín. The country has evidently passed beyond the revolutionary epoch.

So-called tropical diseases introduce questions concerning which the doctors are by no means agreed, but the experience of prudent travelers has demonstrated that the average European may live with security in the steamy tropics by observing certain precautions. The principal ills befalling a stranger in such a climate are malaria and hepatitis. One is likely to be complicated with the other. Continuously moist warm weather tends to produce excessive activity of the liver. An organ under functional strain is predisposed to go wrong upon slight provocation. A chill leads to congestion, and 'bilious fever', to use a popular name, ensues. It is exceedingly easy to become chilled in the tropics, far easier than in the North, because one is almost constantly wet with perspiration; in that condition a draft of air will precipitate disaster. Malarial germs are probably always present in the system to some extent, even in the cooler countries; where the malaria-carrying mosquito abounds, as it does in the tropics, even extreme care will not suffice to prevent innoculation. But if congestion be averted, and the bloodstream be kept pure, Nature may be counted on to protect the health. The white corpuscles are there for that purpose. This is no place for a layman's quasi-medical advice, but it is proper to emphasize my belief, based upon personal immunity during long experience in the swampy regions of Brazil, Eastern Peru, Colombia, and Central America, and upon like immunity on the part of many whom I have known, that rational hygiene will protect a northerner against the dangers supposed to lurk in southern countries. The malaria-carrying mosquito flies only at night and a mosquito-curtain will keep it out; attention to the diet will maintain the liver in working order; and thin clothing will keep the body from becoming overheated. Americans going to the tropics are prone to dress in clothing as inappropriate for the conditions as would be a pongee coat at Dawson in mid-winter. They promptly become overheated, cool off rapidly, and find their systems deranged in consequence.

In spite of the climate, Colombia will soon be overrun with American prospectors. In one sense it is not a 'poor-man's country'. The indigenous foods are cheap, but imported goods are costly. Living is more expensive in Colombia than in the Western States, except during the boom-days of a Nevada mining camp. Furthermore, the foreigner has to pay for being a foreigner. It casts no aspersion upon the character of the Colombian to state this fact. It costs a man more to live in a strange city in his own land than it does in his native town; add to this difficulty the inconvenience of a language imperfectly understood, and the friction of customs divergent enough to offer no hope of familiar comforts, and the costs of living necessarily increase. General merchandise and manufactures cost more in Colombia than in the United States, hence outfitting should be done before departure for the South. Supplies, moreover, should be properly segregated for shipment and billing, to take advantage of the benefits conferred by the customs regulations. All machinery and supplies for mining and agriculture are admitted duty-free. To obtain free entry, however, a consular invoice must be obtained upon such goods. Colombian consuls are stationed at New York, New Orleans, San Francisco, and other ports. The consular fee for a single invoice (*factura*) of certain specified articles, which would include many of those required in an outfit for prospecting or for mine-examination, is $9. An invoice for other goods valued less than $200, costs $18; from $200 to $500 the fee is $24; and above $500, it is $30 for each $1000 or fraction thereof.

Direct communication from New Orleans to Colombian ports does not exist. A transfer at Colón on the Isthmus is necessary. It is best to take the Atlas line from New York; on the west coast the Pacific Mail steamers from San Francisco land the traveler at Panama, the fare being $120. From Panama to Buenaventura, the only important Pacific port of Colombia, the fare is $32. From Colón, at the northern terminus of the Panama railroad, several steamship lines afford communication with the principal Colombian ports on the Caribbean Sea, namely, Cartagena and Sabanilla, the time being respectively 36 hours and 2½ days. A short railroad extends from Sabanilla to Barranquilla, the largest town on the Magdalena river, and another railroad, with a daily train-service extends from Cartagena to Calamar, a port on the river 1½ days journey above Barranquilla. Steamers leave Barranquilla on Mondays and Saturdays, and touch at Calamar. It is more interesting to enter the country through the magnificent harbor and quaint walled city of Cartagena. It is the only walled city in America, and its aspect is decidedly medieval. The only approaches to the great goldfields of the interior are by the Magdalena river from the Caribbean coast, or from Buenaventura to Cali on the west. The auriferous gravels are chiefly along the Cauca river. Ascending the Magdalena the best route is by way of Puerto Bérrio, whence a railroad has been built to Providencia, 30 kilometres (18½ miles) from the important city of Medellín. It is safer for a newcomer to go to a large centre like Medellín and strike out properly equipped from there, than to land at smaller ports on the river,

though they may be geographically nearer some of the gold deposits. The larger opportunities for prospectors lie along that part of the Cauca which is directly west of Medellín, and thence southward, up-stream, toward Popayán. The dredging ground lies chiefly along the lower reaches of the river, and deposits suitable for hydraulicking are more abundant farther south. It is claimed, moreover, that richer gravels exist in that direction, but that is not necessarily true, for the contribution of gold to the stream-gravels occurs throughout the extent of the high range which flanks the valley on the east. To reach the central and upper portion of the Cauca valley, a simpler, quicker, and cheaper route is to go through Buenaventura, from which wretched little port a railway, the Ferrocarril del Cauca, gives



Map of Choco, Colombia.

transport twice each week to Tocotá on the summit of the Coast Range—about 2800 ft. above tide. From Tocotá to Cali is only 30 kilometres, or about 6 hours' ride on horseback. Cali is a pleasant place, and salubrious, as is the entire Cauca valley from that point southward. It consists largely of open plains or savannas, with wooded areas and ravines. From Buenaventura access is also easy by launch or sailboat to Togoromá, the port at the mouth of the San Juan river, which leads up to the great gold and platinum fields of the Chocó. Launches afford communication from Togoramá to Noanamá, and small launches can even ascend as far as Istmina in the centre of the gold-bearing region. The goldfields of the upper Atrato are also conveniently reached by this route, as well as by steamers up that river from the Caribbean.

The outlook for gold mines on the upper reaches of the Magdalena river is promising. In that region exist larger opportunities for finding veins of gold ore than in the Cauca valley. On the great plateau of Bogotá are opportunities of another sort. Great saline and alkaline deposits exist, which have been only imperfectly studied. The famous emerald mines, which are Government property, are at Muso, a half day's ride from Chiquinquirá. A railroad is in operation from Bogotá to Nemocón, 68 kilometres in that direction, and is being extended to Chiquinquirá. A deposit of rock-salt, equal in size to those of Louisiana, exists at Zipaquirá a short distance from Nemocón. The railroad from Girardot, at the head of navigation on the Magdalena river, had for some time rested at El Hospicio, but within the last 30 days the line has been opened for traffic to Bogotá, and trains now run daily between that city and the river port. Steamers from Barranquilla or Calamar go as far as La Dorada at the foot of the rapids. A short railway transfers passengers and goods to Honda at the head of swift water, from which point another steamer continues the voyage to Girardot. Another modern transportation convenience consists in an automobile service from Bogotá to Belén de Cerinza in the Department of Santa Rosa. From this point a good trail leads to Pamplona and Cúcuta, near the Venezuelan frontier. From Cúcuta a good road exists to the Gulf of Maracaibo, the coffee of that region taking the Maracaibo route to the outer world.

From Puerto Wilches on the Magdalena is a short line of railroad extending in the direction of Bucaramanga which is nearly finished, and from the Caribbean port of Santa Marta, famous in history, is a railway to Ciénaga. Precious metals in notable quantity have so far not been found in that part of Colombia lying east of the Magdalena river, but coal, iron, petroleum, asphalt, and ores of lead and zinc are quite widely distributed.

According to the laws of Colombia foreigners may acquire and hold all classes of property, real estate, mines, ships, etc. Public lands (*tierras baldías*) may be freely taken up either by purchase from the Government, or by actual settlement and cultivation, in a manner similar to the method known as 'homesteading'. In like manner no distinction is made between Colombians and foreigners in the location of mining claims. The mining laws of the Republic are too extensive to be safely recapitulated. They constitute a special code (*Codigo de Minas*) of which translations can be obtained in the cities of Cartagena, Medellín, or Bogotá. The spirit of the country is liberality to the foreigner.

Note.—A map of Colombia will be found in the Mining and Scientific Press of February 6, page 217. Since that map was made the Republic has been re-divided for purposes of more efficient administration, into Departments, adding 22 new political subdivisions. Full data for revision of the map have not yet arrived, but references to Departments in the above article are in accordance with the recent change in boundaries.

DITCHES.

Written for the Mining and Scientific Press
By Douglas Waterman.

In the following discussion on the most economic ditch-section, I assume, first, that the cost of the ditch is directly proportional to the amount of material excavated, and second, that the grade is not restricted by the topography, but by the resulting velocity of the water, which must be within safe limits for the material in which the ditch is constructed. These conditions are not often found in large irrigation canals, but apply generally to mining and to power ditches, which are usually constructed in a mountainous country, where any desired grade may be obtained, and of such a size that the excavation offers no mechanical difficulties. Under the above conditions the most economic ditch section is one in which

$$r = \frac{X}{2}$$

Where $r = \frac{\text{Area}}{\text{Perimeter}}$ = Hydraulic Radius

and X = Depth of Water

Let Y = Bottom Width

Z = Top "

θ = Angle of Slope

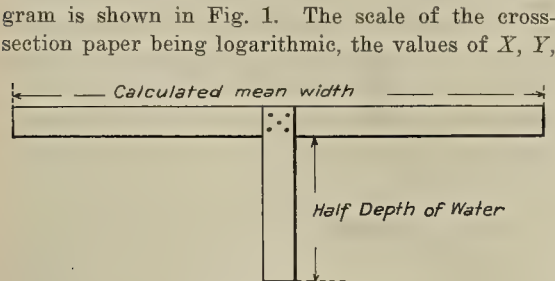
Then $$X = \sqrt{\frac{a}{\frac{2}{\sin\theta} - \cot\theta}}$$

$$Y = \frac{a - X^2 \cdot \cot\theta}{X}$$

$$Z = Y + 2\frac{X}{\tan\theta}$$

The proof of these relations may be found in any treatise on hydraulics.

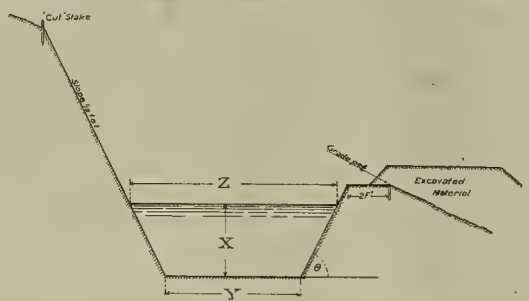
The matter may be best illustrated by an example. For this purpose it will be assumed that a ditch is to be constructed having a capacity of 5000 miner's inches (125 sec. ft.); the velocity of the water to be 3 ft. per second, and the slope ½ to 1. From the relation $Q=aV$, the area of cross-section is found to be 41.7 sq. ft. Q is the capacity of the ditch in cubic feet per second, a the area, and v the velocity in feet per second; thus the values X, Y, and Z may be derived from the above formulae. A convenient diagram is shown in Fig. 1. The scale of the cross-section paper being logarithmic, the values of X, Y,



Ditch Templet.

and Z are represented by straight lines. Referring to this diagram it is found that, for an area of 41.7 sq. ft., $X = 5$ ft., $Y = 6$ ft., $Z = 11$ feet.

In Fig. 2 is shown a graphic method for determining the economic section of a conduit where the radius of the inscribed circle is known. The flow of water is a maximum, and the amount of excavation a minimum when the section has the least wetted perimeter. It is obvious that for a given area, the circular section has the least wetted perimeter. But conduits as usually constructed have a trapezoidal cross-section, in which case the circumscribed trapezoid gives the least wetted perimeter. Values of R in terms of the area are given for slopes ranging from vertical, to 1½ to 1. The area being given by the relation $a = \frac{Q}{V}$, R for any slope may be taken from the diagram.



Economic Ditch Section.

Describe a circle to scale with this radius. Draw a line through the centre, and a parallel tangent to the circle. Lay off the slope as shown by the dotted triangles, and draw tangents to the circle. This will give the economic section. It will be seen that for a rectangular section, the width is twice the depth.

It now remains to determine the grade, which is found from Kutter's formula:

$$(1)\quad V = C\sqrt{r}\cdot\sqrt{S}$$

$$(2)\quad \sqrt{S} = \frac{V}{C\sqrt{r}}$$

$$(3)\quad C = \frac{\frac{1.811}{n} + 41.65 + \frac{0.00281}{S}}{1 + \frac{n}{\sqrt{r}}\left\{41.65 + \frac{0.00281}{S}\right\}}$$

V is given $= 3$ ft per sec.

$$\sqrt{r} = \sqrt{\frac{X}{2}} = \sqrt{2.5}$$

n = coefficient of roughness, which from the table is assumed to be 0.035.

S—the slope or grade of the ditch—is unknown, but may be found by the method of approximation.

To obtain a first approximation for C in equation (3), the terms involving S, being small, may be neglected. Giving C this value in (2) we obtain a value for S, which substituted in (3), gives a closer approximation for C; the final value of S is derived from equation (2).

First approximation.... $C = 48.67$ $S = 0.00152$
Second approximation.. $C = 48.84$ $S = 0.00153$

Hence the rod-change for 25-ft. stations is 0.038 ft. Owing to the uncertainty attending the choice of a proper coefficient of roughness such refinement is un-

necessary, and the rod-change may be taken as 0.04.

To avoid these calculations the value of S may be read directly from 'Church's Diagram of Mean Velocity of Uniform Motion of Water in Open Channels.' These diagrams will be found useful in many problems which are difficult of solution by the direct application of Kutter's formula.

Values of the coefficient of roughness (n).[1]

$n = 0.009$ for well planed timber, evenly laid.

0.010; plaster in pure cement; glazed surfaces in good order.

0.011; plaster in cement, with one-third sand; iron and cement pipe in good order and well-laid.

0.012; unplaned timber, evenly laid and continuous.

0.013; ashlar masonry and well-laid brick-work; also the above categories when not in good condition not well-laid.

0.015; canvas lining on frames; brick-work of rough surface; foul iron pipes; badly jointed cement pipes.

0.017; rubble in plaster or cement in good order; inferior brick-work; tuberculated iron pipe; very fine and rammed gravel.

Values of n for irrigation ditches and canals.[2]

$n = 0.0175$ for canals in earth in excellent condition, well coated with sediment, regular in cross-section, and free from vegetation, loose pebbles, and cobbles.

$n = 0.02$ for canals in earth in good condition, lined with well-packed gravel, partly covered with sediment, and free from vegetation.

$n = 0.0225$ for canals in earth in fair condition, the wetted surface being lined with sediment, with an occasional patch of minute algae, or compound of loose gravel with vegetation.

$n = 0.025$ for canals in earth in average condition, having few sharp bends and being fairly uniform in cross-section; the water-slopes and bottom being lined with sediment and minute algae, or compound of loose coarse gravel and fragments of rock less than 2 in. diam., and free from vegetation.

$n = 0.0275$ for canals in earth, below the average in grade, alignment, and cross-section; having indentations on the sides; the edges in places being partly filled with earth and gravel, and the lining composed of coarse gravel and cobbles unpacked. This value would also apply to a smooth regular surface if the channel were partly filled with aquatic plants.

$n = 0.03$ for canals in earth in rather poor condition, having the bed partly covered with debris, or having comparatively smooth sides and bottom, with bunches of grass and weeds projecting into the water, and with aquatic plants growing in the channel.

$n = 0.035$ for small ditches having a rough uneven bed, and for canals in earth in fairly good condition, but partly filled with aquatic plants.

$n = 0.04$ for canals in earth, the channels half-filled with aquatic vegetation.

$n = 0.05$ for canals in earth, the channels two-thirds filled with aquatic vegetation.

We have now all the necessary data for laying out the ditch. Grade stakes are set every 25 ft., and 'basketed' by three heavy stakes before grading begins. In setting 'cut' stakes, the rodman with tape in hand climbs the hill to what he judges to be the proper distance, and holds the rod in a vertical position, with the target set at the height of the instrument-man's eye. The vertical angle is read with a clinometer. The slope distance and cut are read from tables, recorded in the note-book for future calculations, and called out to the rodman, who marks the cut on a stake and drives it at the proper distance. The cut and slope-table mentioned may be computed for the ditch under construction. It is economy to have, besides the rodman, a chainman and stake-bearer.

The prismoidal formula used in calculating yardage is

$$\frac{a + 2b + 2c + 2d, \text{ etc.}}{2 \times 27} \times 25 = \text{cu. yd.}$$

Where a, b, c, d, etc., are the areas of cross-section at successive stations.

But for a ditch, the first and last areas may be dropped and the formula reduces to the simple form

$$\frac{b + c + d + \text{etc.}}{27} \times 25 = \text{cu. yd.}$$

From the calculated section of the ditch a mean width is obtained at half the depth of the water. A templet is then made, and is used as a guide in digging the ditch. The width of the ditch at this point remains a constant, irrespective of the slope of the banks. The slope of the banks varies from vertical, to ¾ to 1 (horizontal distance expressed first). The natural slope of loose earth is 1½ to 1. It is usually cheaper to allow the bank to form its own slope and to sluice the resulting material through waste-gates, which should be placed every half-mile or less for this purpose; the bottom of the sand-box is dropped one foot below the bottom of the ditch.

SAFE VELOCITIES OF WATER FOR DITCHES IN DIFFERENT MATERIALS.

	Velocity.
Silt	0.5
Soft loam	0.65
Sandy soil	1.3
Loose gravelly soil	2.5
Firm soil; firm sandy loam	3.0
Gravel	3.6
Firm gravelly soil	5.3
Broken stone	5.6
Soft rock	6.5
Conglomerate; soft slate-schist	6-7
Stratified rock	7-9
Hard rock	12-15

From the fore-going discussion it will be seen that the two vital points in the design of a ditch are: the proper choice of the velocity of the water, and of the coefficient of roughness. These factors will of course vary greatly under different conditions, but in order

	Name of Ditch	Length in Miles	Capacity in Miners Inch.	Equiv. of M.I. Cub. Ft. per min.	Capacity in Sec. Ft.	Grade per Mile	Dimensions			Area	r = a/p	V	n
							Depth	Bottom	Top				
South Yuba Canal	North Bloomfield Ditch	40	3200	1.57	84.	16	3.5	5	8.6	23.9	1.8	3.5	0.035
	Eureka Lake Miner's Ditch	25	700	1.5	175	9.6	2	3	5	8	1.1	2.2	0.03
	San Juan Main Ditch	32	1236	1.5	31	9.6	3	4	6	15	1.4	2.1	0.035
	Main Ditch to Head of Deer Cr	17	5200	1.5	130.	13	3	6	8	35	2.2	3.7	0.035
	Dutch Flat Ditch	13	3100	1.5	77.5	13.3	5	4	6.5	26.2	1.8	3	0.035
	Blue Tent Branch	13	2300	1.5	57.5	13	4	4	6	20	1.6	2.9	0.035
	Chalk Bluff Ditch	13	2700	1.5	67.5	16	4	4	6	20	1.6	3.4	0.03
	Cascade	25	1600	1.5	40.	12	4	4	5	18	1.5	2.2	0.035
	China	33	1700	1.76	50.5	9	4	5	8	26	1.9	1.9	0.04
	Bouyer	15	1200	1.76	35.6	13	3.5	4	8	21	1.8	1.7	0.04
	La Grange	20	2400	1.5	60.	8	3	6	9	22.5	1.8	2.6	0.03

[1] Irving P. Church.

[2] Dr. Samuel Fortier. Water Supply and Irrigation paper No. 43, U. S. G. S.

that some idea may be formed of the values of V and n as applying to mining ditches in California, I have extended the table given by Bowie in his 'Practical Treatise on Hydraulic Mining', to include the coefficient of roughness and the velocity. As the coefficient of roughness is based upon the quantity of water delivered, it allows for seepage and other losses throughout the length of the ditch.

A favorable position for the waste-gate is one where the bedrock is exposed or near the surface, as there is then little danger of undermining the ditch. The waste-way should be built to afford ample protection of the banks. In a timbered country, where wind-falls are always to be expected, the slopes should be cleared of brush and trees for a distance sufficient to prevent clogging of the ditch or injury to the banks. The greatest precaution should be taken to protect the flumes from forest fires. In digging a ditch it will be found that the ground in many places is loose and porous. Clay is the best material with which to puddle a ditch, and workmen should be instructed to save suitable material for this purpose. Small charges should be used in blasting where there is danger of shattering the bottom or lower side of the ditch.

Giant powder containing 60% nitro-glycerine will be found better adapted to ditch construction than a lower grade explosive, as the relative shattering effect of a 'quick' powder is much less than with one incapable of a high degree of detonation. Also, in order to insure such effect a high-force cap, not less than 5X, should be employed. A half cartridge will break a 14-in. burden perfectly.

Level Notes for Ditch — Survey Book 1 — Pg. 5

Sta	+ S	H I	− S	Elev	Grade	Rod	Remarks
B M	3.25	103.25		100 00			On Oak Tree 100 Ft Rt. Sta 0+00 at head gate
0+00					100.00	3.25	Rod change + 02
+ 25					99.98	3.27	
+ 50					99.96		
+ 75					99.94		
1							
+ 25		See Book 10 pg. 23					
+ 50							
+ 75							
2							
T. P.				5.79	97.46		
9 + 50							

Level Notes for Ditch — Survey Book 10 — pg 23

Sta.	+ S	H. I.	− S	Elev.	Grade	Rod	Remarks	C. L.	C. C.	C. R.
1 + 25										
+ 50										
+ 75										
2							Through Cut			
		See Book 1 pg 5								
9 + 50										



Ditch Building in California.



Truckee-Carson Irrigation Canal.

Fig. 1 Diagram – Economic Ditch Section – Slope ½ to 1

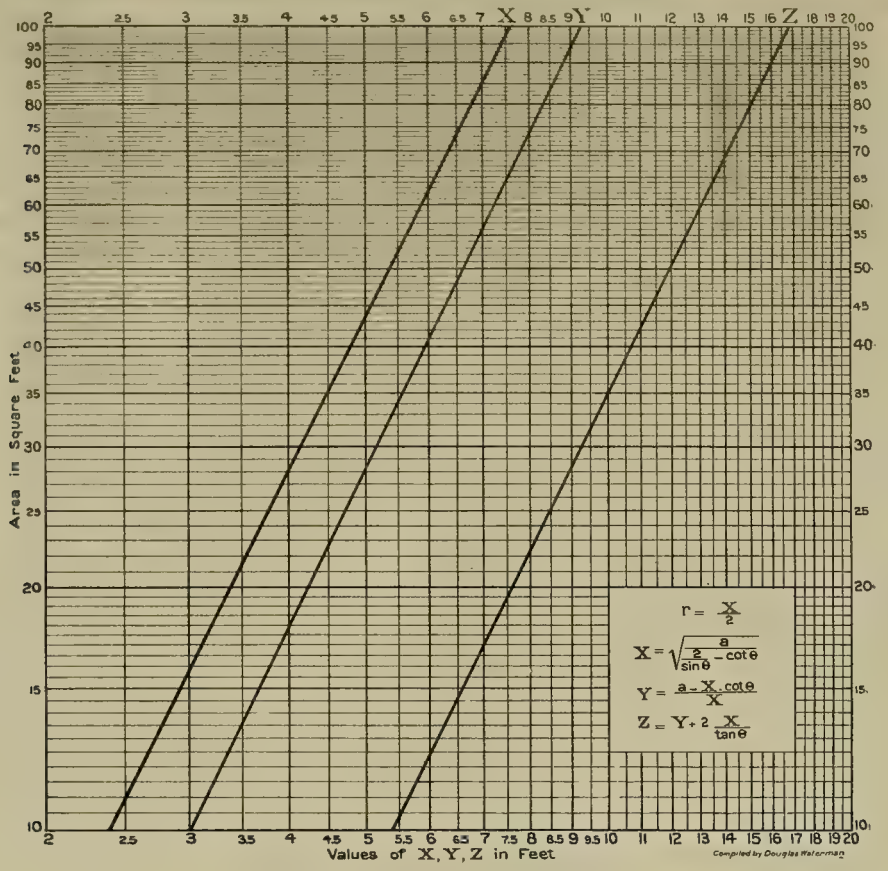
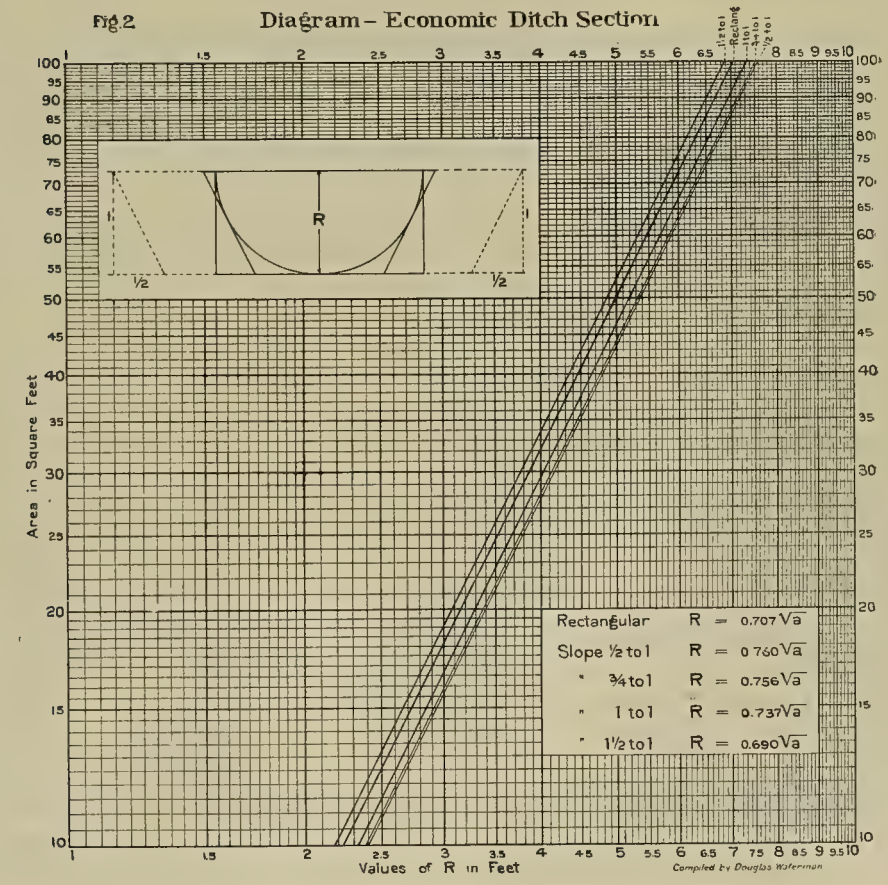


Fig. 2 Diagram – Economic Ditch Section



CHEMISTRY OF THE BROMO-CYANOGEN PROCESS.

Written for the Mining and Scientific Press
By S. H. Worrell.

In 1894, Sulman and Teed, two English metallurgists, obtained a patent for a process of gold extraction involving the use of bromo-cyanogen with the regular cyanide process. They claimed for their process greater rapidity and higher percentage of extraction in the case of complex ores than could be obtained with the McArthur-Forrest method alone. In Vol. III. pp. 202-224, of the Transactions of the Institution of Mining and Metallurgy, Mr. Sulman gives an extensive list of results obtained on complex ores. These results were favorable to the process, which under the name of Diehl, has been successfully applied and now seems to be a well established method of gold extraction.

The only late contribution on the subject, so far as the writer has been able to find, is the article by E. W. Nardin which appeared on October 31, 1908, in the Mining and Scientific Press, to which the reader is referred for a detailed statement of the technical application of the process. In Vol. I of the Proceedings of the Chemical and Metallurgical Society of South Africa (1894), there appears an interesting discussion of a paper by H. L. Sulman, who believed that he had found in bromo-cyanogen a substitute for the slowly acting oxygen of the air necessary in the McArthur-Forrest process. The reaction underlying the latter, called Elsner's equation, is as follows:

$$4KCN + 2Au + H_2O + O = 2KAu(CN)_2 + 2KOH$$

Mr. Sulman gives the reaction for his process as follows:

$$3KCN + BrCN + Au_2 = 2KAu(CN)_2 + KBr$$

Not only Mr. Sulman's process, but his reaction as well, seem to have met with a reception more sarcastic than friendly, judging from the discussion which followed. J. E. Clennell did some work on the process in an attempt to solve the reactions occurring and gave the following as suggesting what happens:

$$5KCN + 2BrCN + Au_2 + H_2O = 2KAu(CN)_2 + 2KBr + KCNO + 2HCN$$

However, he did not wish to be understood as asserting positively that the above is the reaction in the case. He experimented qualitatively only on KCN and BrCN solutions in which gold was not present at all.

The article by Nardin gives the Sulman equation in explanation of what is, as the author puts it, "supposed" to happen. A knowledge of what really happens seems desirable, and so far as I have been able to ascertain, it has never been determined. Herewith follows a brief outline of some work done with this end in view.

Chemically pure BrCN was first prepared as follows: (Ber. 1896, Vol. 29, pp. 1822-25). A solution of 65 grams KCN of 98% in 120 c.c. water was cooled to 0° C. and added drop by drop with shaking to 150 grams bromine covered with a little water. The temperature of the bromine should not be allowed to rise above 30° C. Add the KCN until the Br becomes yellow. Then distill the pasty mass at 65° C. This will give white crystals of c.p. BrCN. The crystals so prepared were placed in solution in water. This solution, of about 2%, was found to be stable.

Finely divided gold, purified by repeated precipitation with oxalic acid, was used in all the work. The KCN was 98 per cent.

To a measured quantity of 0.5% solution of KCN, was added the finely divided gold in large excess and air was drawn through the solution from six to eight hours, for the purpose of keeping the gold agitated and supplying the necessary oxygen to carry out Elsner's equation. The solution was then filtered and the gold washed. The solution so obtained was made up to 500 c.c. and an aliquot part taken to determine the amount of KCN consumed. This was done by titration with silver nitrate. The remainder was treated with sulphuric and oxalic acids to precipitate the gold. The precipitate was then collected on filter-paper, dried, burned, the residue being fused with mixed alkali carbonates to which had been added a little flour and sheet lead. The fused mass was leached with water and the lead button cupelled for gold. Similarly, to another measured quantity of the KCN solution were added the gold and a measured quantity of the BrCN solution, the whole being then agitated intermittently from two to four hours. The amount of BrCN added in every instance was such that it contained less cyanogen than was present in the KCN solution taken (Sulman's suggestion). The solution was then made up to some definite quantity, generally 500 c.c., as in the first case. Then 250 c.c. was taken for the determination of gold and 100 c.c. titrated for the cyanide consumption.

A statement of some results is appended: In the first case the solution was approximately 0.5%; in the second case a solution slightly different was taken. In the first case 50 c.c. was taken, and in the second 250 c.c., made up to 500 c.c. in each instance:

	KCN consumed, c.c.	Weight of gold in aliquot part, grams.	Total weight of gold, grams.	Weight of gold per c.c. KCN consumed, grams.
First solution, with air.....	26	0.0252	0.0504	0.00193
First solution, with BrCN...	37	0.0680	0.1360	0.00370
Second solution, with air...	90	0.0830	0.1035	0.00115
Second solution, with BrCN.	86	0.1018	0.2036	0.00236

From the above it will be seen that twice as much gold is dissolved with the same amount of KCN when bromo-cyanogen is used instead of oxygen of the air. In explanation of the above the following reaction is suggested:

$$2KCN + Au_2 + 2BrCN = 2KAu(CN)_2 + Br_2 = 2AuCN.Br.KCN$$

the proportions in Elsner's equation being

$$4KCN + Au_2 + H_2O + O = 2KAu(CN)_2 + 2KOH$$

According to *Bull. de Soc. Chem.*, Paris, 29-416 (1st

series), $KAu(CN)_2$ forms absorption-products readily with the halogens, which explains the formation of the AuCN.Br.KCN suggested above.

In closing, it may not be amiss to call attention to the fact that the simple addition of bromine to cyanide solutions when treating ores cannot be substituted for the bromo-cyanogen process in practice, for the reason that to give a good yield of BrCN the temperature must be near freezing, otherwise oxidation products and consequent loss of Br and KCN will result. Also for every molecule of KCN.AuCN present already in the solution, there is a probability of loss of a molecule of bromine by absorption, and thereby temporarily, if not permanently, putting it out of commission without having accomplished its intended purpose.

CALCULATION OF HEAT CONDUCTIVITIES.

By Carl Hering.

*In calculating the heat losses by conduction through the walls of furnaces made of several materials, as, for instance, firebrick on the inside and infusorial earth on the outside, it is necessary to know what the heat conductivity is for firebrick between two high temperatures. The calculation is limited to the ranges given in the usual text-book tables. If, for instance, the heat conductivity for firebrick is given as 0.0014 as a mean from 0° to 500°, and 0.0031 as a mean from 0° to 1300° C., it is possible to calculate correctly the corresponding figure between the two given high temperatures, 500° and 1300°. These particular values are in the c.g.s. system and mean the calories per second which will pass through 1 cm. of the material, 1 sq. cm. in section, for a difference of 1° C. between the two surfaces.

Let k be this heat conductivity for the lower range of temperature t, and K the corresponding figure for the higher range T; let t′ and T′ be the two maximum temperatures of the ranges t and T, respectively; and let H represent the heat in calories per second passing through a body. For 1 cu. cm.

$$H = kt.$$

Assume another piece of the same material, also 1 cm. in cross-section, and of such length, L, that it will conduct the same quantity of heat, H, when its ends have the temperatures 0° and T′, for which the mean conductivity is K. For this rod

$$H = \frac{KT}{L}$$

but as the heat-flow H. is by definition the same in both, it follows that

$$(1) \qquad kt = \frac{KT}{L}$$

This may be represented diagrammatically by a cube and a parallelopiped, referring the heat conductivity to unit volumes. Now, let x be the quantity desired, namely, the mean conductivity between the two higher temperatures t′ and T′. It can be shown by diagrams that, as the flow of heat is the same in both, it necessarily follows that the longer rod will have a temperature of 500° at a distance of 1 cm. from the cool end, because that last centimetre must be under precisely the same conditions as the cube above, in order that the flow of heat be the same. Hence, it follows that there will be a fall of temperature from T′ to t′ over a length of this rod equal to L — 1; and as the heat flowing through this portion is the same as through the whole rod, it follows that

$$(2) \qquad H = \frac{x(T' - t')}{L - 1} = kt$$

Eliminating L from equations (1) and (2) and solving for x gives the desired quantity

$$x = \frac{KT - kt}{T' - t'}$$

Applying this by illustration to the above data for firebrick, it will be found that

$$x = 0.00416,$$

which, therefore, is the mean heat conductivity of firebrick for the range 500° to 1300° C.

Incidentally, it may be of interest to solve equation (1) for L, and it will be found to be 5.76 cm. A diagram will show graphically what a large amount of firebrick is necessary to reduce the temperature in the walls from 1300° to 500° (namely, 800°), and what a relatively small thickness is required for the remaining 500°. This, of course, is due to the fact that firebrick rapidly loses its insulating properties at high temperatures. It shows how important it is to have as thin a layer of firebrick and as thick a layer of infusorial earth as possible, the relative amounts depending upon the maximum temperature at which the high insulating material will retain its good quality.

*Abstracted from *Electrochemical and Metallurgical Industry.*

Volumetric estimation of potassium with cobalt nitrate, is a method worked out by Drushel (*Am. J. Sci.*, XXIV, 433). The solution, which should contain not over 0.2 gm. K_2O, and should be free from NH_4 salts, is treated with an excess of sodium cobaltinitrate, and evaporated to pastiness on the water-bath. Cool, and add 50 to 100 c.c. cold water, and stir well to dissolve the excess of the precipitant. Wash a few times by decantation, using cold water, and then transfer to a Gooch filter. Dilute a measured excess of standard permanganate to about ten times its volume and bring to a boil. Introduce the filtering felt and finally the Gooch, and stir well. After 5 or 6 minutes add 5 to 25 c.c. of H_2SO_4 (1:7) and allow to stand a short time. Then run in an excess of N/10 $H_2C_2O_4$ solution from a burette, heat until colorless, and titrate with the standard permanganate. The total amount of permanganate used, less that required for the $H_2C_2O_4$ introduced, is calculated to K_2O. If the permanganate is exactly N/10, 1 c.c. equals 0.000856 K_2O. The N/10 $H_2C_2O_4$ is made by dissolving 7.1066 gm. pure recrystallized $(NH_4)_2C_2O_4 2H_2O$ in water, adding 50 c.c. strong H_2SO_4, and diluting to one litre. Ca, Mg, or P_2O_5 do not appear to interfere. Ba or Sr in the solution seems to give high results.

The Western Pacific tunnel under the Pequop mountains in Elko county, Nevada, has recently been completed. It is 5657 ft. long.

CHURN-DRILL SAMPLING.

Written for the MINING AND SCIENTIFIC PRESS
By W. E. THORNE.

The best practice today is to drive the pipe 1 ft. ahead and then drill 10 or 11 in. In discharging material from the pump into the sample-box the thin portion is allowed to run out, and then the panner places his pan under the hole in the pump,

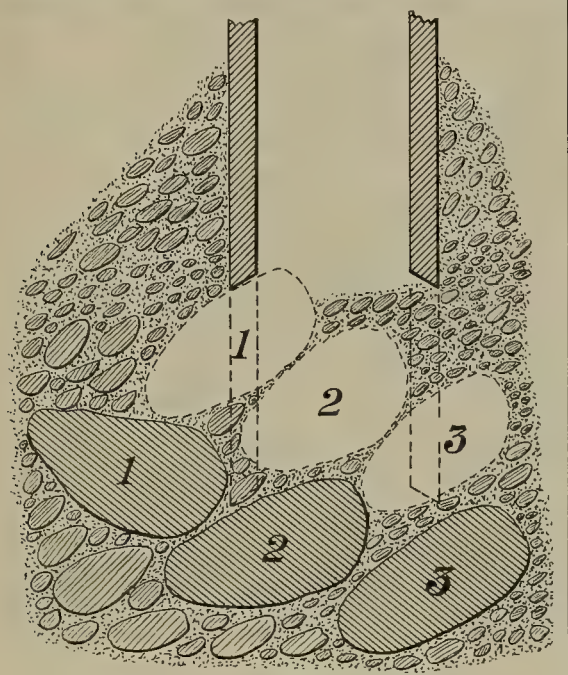


Fig. 1.

and catches the coarser part of sample. As many pumpings for each foot of sample are made as the panner thinks is required to get the amount of material that should be in the sample. Usually two or three pumpings are enough. The character of material governs, for in some gravel a pumping will

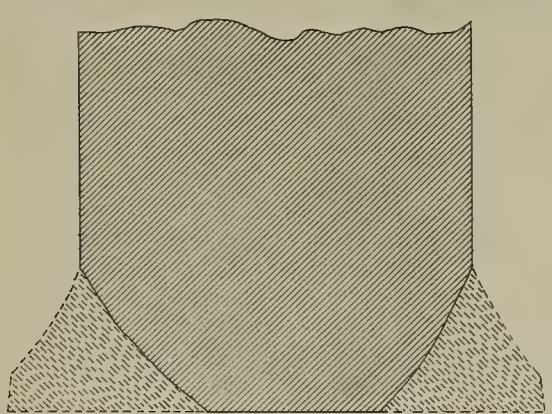


Fig. 2.

yield a pan three-quarters full, while in other cases it will be less than half full. A core is always left in the pipe; the depth of this core must be determined by experiment; it should be enough to hold back the water on the outside of the pipe and prevent it breaking in with a rush. If it does that some gold may be carried in from outside, and the sample will show a value in excess of the truth. After that the drill is lowered into the hole until it reaches the core; the drill-runner notes the height of the core, and calls it to the panner, who records it in the 'log.' Then the pipe should be filled with water to the same level as the ground-water outside; this is to prevent an inrush of water when the core is pumped down close to the cutting edge of the drive-pipe. The core is loosened by the bit, and the pipe is driven another foot. If the core is not loosened in some cases it

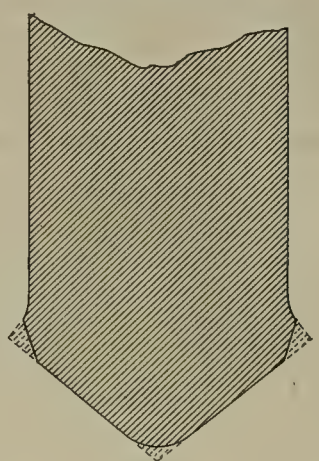


Fig. 3.

becomes so solidly packed that on driving, the result is like driving a pile, and part of the gravel, carrying gold, is forced to one side.

A flat rock struck by the shoe and forced ahead

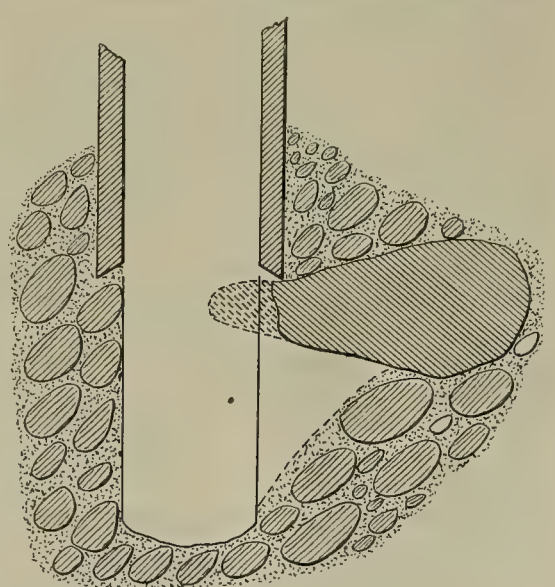


Fig. 4.

will also drive the gravel to one side. This should be detected by the driller. The coarse material is panned in a tub, and the size and number of 'colors' found are recorded. The pannings from the tub, and the sample in the sample-box, go through the rocker, and the concentrate from the rocker is again panned,

so that 90% of the sample is panned at least twice. When the hole is finished the gold in the pan-concentrate is amalgamated, and the amalgam is placed in a small phial and taken to a laboratory, where it is treated with nitric acid to remove the mercury. The gold is dried, annealed, weighed, placed in a phial, marked and filed for future reference.

In one case in California, in drilling loose ground, the drill-runner had instructions to carry from 1 to 2 ft. of core. As a result this core would become solid at times, and so much of the material was driven to one side that the drill-tests showed a low gold-content, and the property was 'turned down.' Later others tested the ground by shafts. The returns were good, and the property was bought, a dredge built, and it has proved profitable.

In Fig. 1 it is shown how a shoe sometimes strikes on a boulder. I have found in medium loose gravel that the boulders will be driven ahead as shown in Fig. 1; No. 1 boulder will have been forced down, and to one side; the gold immediately above and on each side will follow down, and be carried to one side, while a part of it will be lost from the sample. Boulders No. 2 and 3 will be driven ahead. In some cases No. 3 will also be driven to one side, and a part of the gold with it. Sometimes No. 2 and 3 will be broken, and finally come up into the pipe, causing too high a gold recovery. If either of these cases occur in the pay-streak, it will cause an appreciable error, as a difference of one milligram of gold per foot in depth means over 5c. per cubic yard. I have had test-shafts sunk on drill-holes, where the drill-log showed fine gravel all the way down, when in fact there were boulders from 12 to 14 in. long in the material. As revealed by the shaft these boulders had been driven down and to one side, carrying a part of the gold with them, as returns from all the gravel taken from the shaft showed a value as much as 60% higher than the drill-test. This error was partly caused by using a rock-bit in the work, and in not keeping it sharp. This resulted in the bit becoming rounded as shown in Fig. 2 and 3.

In some sampling which I had done in Colorado a few years ago during two working seasons, two drills were running during the first season, a Keystone No. 2 and a Clipper No. 2. The drill foreman was well recommended, so but little attention was paid to the work. On going over the results and sampling by shafts I found that the results were over 100% too high. The foreman and the crews were dismissed, and two new crews put on. Instructions were given that more care must be used, but not to 'lead the shoe' except where driving could not be done without it; then to run the bit ahead just enough to break the boulder so that the pipe could be driven. One of the main sources of error on this work, as shown by testing with shafts, proved to be that seen in Fig. 4. After the bit had cut or broken the boulder, the shoe would strike it, as shown. If the bit had been leading the shoe, in attempting to drive it, the gold around a part of this boulder would get into the hole, causing an excess. After the first season's drilling the clean-up showed in the sluices nowhere near the amount of gold revealed by the drill-returns; accordingly, before the next season's hydraulicking began, I had the ground re-drilled just ahead of the sluices, five holes to each acre. At the end of the second season's clean-up the returns were 9.8% above the drill-test. This was caused by the length of the sluice, which was some 1200 ft., so the loss was small. If I had used a short line of sluice, or a dredge, I doubt if the saving would have reached 95% of the drill-return.

No property should be considered proved by a drill alone; it should be checked by shafts. While the drills may show clay, cemented gravel, the kind of bedrock, and the like, they are not reliable in indicating the size of boulders, nor can they be absolutely trusted in the gold indicated. Drilling is cheaper and more rapid, but, after a preliminary examination of a property, if it be considered worth prospecting it should at least be well done, and it cannot be well done without a few shafts.

It may appear to the layman that these errors would balance each other, but they will not, because no two deposits are exactly the same, and that which causes an error in one deposit may not occur in another.

New concrete will not retain oil-paint because of dampness, and the presence of caustic lime. Time and nature will remove these objections, the carbonic acid of the air neutralizing the lime, but we shall hardly be allowed to wait for it. Acid will certainly do away with the caustic lime, but the remedy is about as bad as the disease, the salts of lime which are formed being either highly hygroscopic, like calcium chloride ($CaCl_2$), or the action being too superficial. After exhaustive trials Fred. J. Bosse has worked out the following method as the only one which will satisfy the needs for a paint on concrete: Dissolve 10 lb. carbonate of ammonia in 45 gal. water and apply with a brush; or make the solution weaker and give several coats, or apply as a spray. The following reaction takes place:

$$CaO + (NH_4)_2CO_3 = CaCO_3 + H_2O + 2NH_3$$

The ammonia which is liberated will evaporate, and the calcium carbonate which has been formed is perfectly insoluble and will become dry and hard in a short time. On the surface thus prepared ordinary oil paint may be applied. This process will be found convenient, cheap, and efficient.

The controversy between the Calumet & Hecla Mining Co. and the Osceola interests has been settled by an agreement whereby the Calumet & Hecla will absorb the Bigelow properties, including not only the Osceola but also the Tamarack, Ahmeek, Seneca, Laurium, and one third of Isle Royale. A decision by the Court of Appeals at Cincinnati recently confirmed the right of the Calumet & Hecla to vote the Osceola stock, of which the C. & H. owns 20,000 shares, and holds proxies for 25,000 more. It is understood that the transaction involved a transfer of 125,000 shares of stock at a price aggregating $8,000,000.

COMPANY REPORTS.

MAZUMA HILLS.

This is the principal company operating in the Seven Troughs district, near Reno, Nevada. The full name is Mazuma Hills Mining Co. According to the second annual report, for the year ending December 31, 1908, the output was 2474 tons, worth $114,092. The profit was $25,001. John Harnan is president and J. T. Hawkins is engineer.

DALY-JUDGE.

According to the annual report of the Daly-Judge Mining Co. for the calendar year 1908, the receipts were $285,570, of which $14,166 was for zinc middling. The balance on hand is $131,997, this sum having increased $4342 during the year. Extraction of ore cost $2.77 per ton and concentration 86 cents per ton. The shaft is 1650 ft. deep. E. W. Durfee is superintendent. The mine is situated at Park City, Utah, but the company is controlled at Cincinnati, Ohio.

MOUNT MORGAN.

The report of the Mount Morgan Gold Mining Co. for the half-year ended November 30, 1908, shows a total revenue of £507,239, as against an expenditure of £375,410. The profits amount to £131,829, from which two dividends of 5% have been declared, absorbing £100,000. This great gold mine is now an important producer of copper; during the six months under review 3272 tons of blister copper and 230 tons of copper precipitate were obtained from the 222,793 tons of ore mined. The average gross price obtained for the copper was £59 3s., compared to £65 18s. realized in the preceding half-year, irrespective of gold contents. The yield of gold was 84,037 ounces.

FIRST NATIONAL COPPER.

The First National Copper Co. is the holding company controlling the Balaklala Consolidated Copper Co. Thomas W. Lawson is president of the first and Thomas J. Barbour is president of the second. R. T. White is manager at the smelter and R. N. Bishop manager at the mine, in Shasta county, California. The first annual report, for the year ending December 31, 1908, shows that the capital stock of the Balaklala was purchased for $1,500,000 and then the operating company was organized with a capital of $10,000,000, besides $750,000 in bonds. During the year the mine was in operation for 60 days and the smelter for 52 days. The ore developed is stated to average 2.7% copper, 0.025 oz. gold, 0.75 oz. silver per ton. The capacity of the plant is 1250 tons per day. Costs of mining averaged $2.42, and smelting, $2.92 per ton. The maps accompanying the report are examples of poor draftsmanship. Of the 24,943 tons smelted, 15,960 came from the Balaklala mine, 7286 from the Trinity, and 1697 tons was custom ore. The average slag analysis is given as 0.19% copper, 40.9% SiO_2, 37.5 FeO, 9.9 CaO, 8.1 Al_2O_3, and 2.5 ZnO. Coke forms 5.9% of the total burden and 7.58% of the weight of sulphides.

BRITISH COLUMBIA COPPER CO.

The above-named company, with mines in the Boundary Creek district and elsewhere, and a smelter at Greenwood, B. C., produced 5,767,355 lb. of copper in the fiscal year ending November 30, 1908. The ores also yielded 13,597 oz. gold and 58,204 oz. silver. The proceeds from shipments of metal amounted to $1,086,635, to which sundry profits from other sources added $13,324. A net profit of $200,483 was realized. The authorized capital stock of the company is $3,000,000, in $5 shares, of which 503,000 shares have been issued to date. The smelter is equipped with three blast-furnaces and two stands of converters. The material treated during the year was 312,471 tons of ore from the company's mines, 4829 custom ore, 3846 converter slag, and 281 tons custom matte. Total cost of producing refined copper, including expense of marketing, was $2.63 per ton of ore handled, or 9.996 cents per pound of copper, after crediting expenditure with the gold and silver produced. The report claims large additions to the ore-reserves, but measured quantities are not given. This is a serious omission, as no means of estimating the future possibilities of the mines are furnished. The record of development carried forward is given in the most general terms, and the absence of maps renders the information of no value in elucidating the situation. The company makes a favorable financial showing, which is especially commendable, in view of current market conditions. It would have added to the value of the statement to have supplemented it with more data concerning the mines and available ore-supply.

GUGGENHEIM EXPLORATION CO.

The annual report covering the calendar year 1908 shows liabilities and assets as follows:

Capital stock	$22,000,000
Bills and accounts payable	1,003,531
Surplus	13,643,689
Total liabilities	$36,647,220
Treasury stock	$ 1,319,900
American Smelters Securities Co. (A)	13,860,000
American Smelters Securities Co. (B)	199,890
American Smelters Securities Co. Common	1
Other properties and investments	17,589,487
Furniture, fixtures, and equipment	7,706
Bills and accounts collectable	2,083,436
Cash and demand loans	1,586,800
Total assets	$36,647,220

AMERICAN SMELTING & REFINING CO.

An interim statement has been issued to the stockholders of the assets and liabilities on October 31, 1908, and earnings for the first six months of the fiscal year. These figures show a profit of over 8% per annum on the common stock. Daniel Guggenheim, the president, states: "The business and earnings of the company declined from the beginning to the end of the fiscal year ending April 30, 1908. Since the beginning of the present fiscal year, however, the earnings have been gradually improving month by month. The company has not, in the past, issued reports to the stockholders with reference to the business of the company oftener than at each annual meeting, principally for the reason that it is both difficult and expensive to accurately cut off the business oftener than once a year, on account of the large value of precious metals in process of smelting and refining. The directors believe, however, that the desire of the stockholders for accurate reports as to the operations and profits of the company as often as is practicable is warranted."

The profit and loss statement for the six months ending October 31, 1908, shows:

Net earnings from operations		$ 3,917,684
Construction and improvements		75,923
		$3,841,761
DIVIDENDS.		
Preferred, 3½%	$1,750,000	
Common, 2%	1,000,000	— 2,750,000
Net surplus to profit and loss		$ 1,091,761

ASSETS.

Property	$ 86,845,676
Investments	2,858,617
Metals (refined value)	18,218,785
Material	1,249,561
Cash and demand loans	8,629,550
Total	$117,802,184

LIABILITIES.

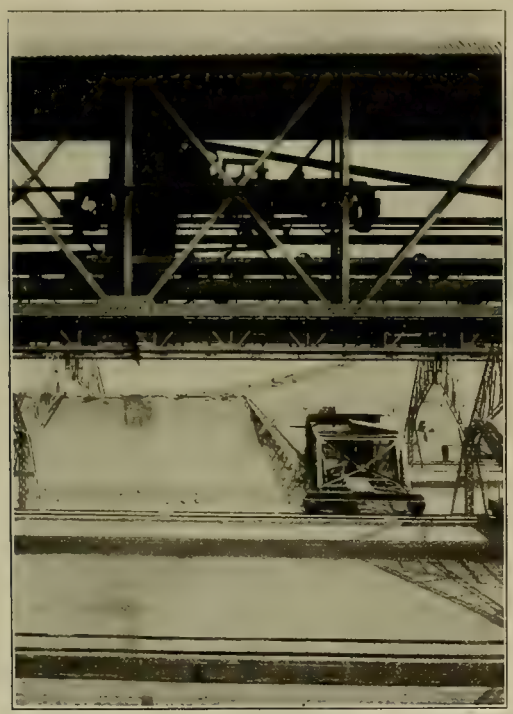
Capital stock	$100,000,000
Bonds	349,000
Net current liabilities	804,645
Unearned treatment on metals in process	2,148,559
Profit and loss	14,499,979
Total	$117,802,184

Ore-Bedding System.

By E. H. Messiter.

In the Mining and Scientific Press of October 26, 1907, I described the new method of blast-furnace charging utilizing the Robins Conveying Belt Co.'s ore-bedding and reclaiming devices. This system was installed at the works of the Cananea Consolidated Copper Co. On July 11, 1908, the plant went into regular operation.

The re-construction of the Cananea smelter is interesting in many ways. In fact, it may be said to be unique, both as to method and results. Instances in which a furnace-house, a power-house, or a convertor-house, laid out at first for a small capacity, has been brought up to the highest efficiency after it had outgrown itself are not rare; but it has seldom been possible in the past to find a plant that has grown from two small furnaces to eight large ones and to bring the whole plant up to date. As soon as we cease to deal with the separate parts by themselves, the question of the handling of material becomes the great obstacle. Formerly



View Across Ore-beds; the Ore-bedding Tripper is Dropping Ore on the Bed in the Foreground, While the Reclaiming Machine is in Operation on the Far Bed.

the question of the transmission of power was another difficulty, but the use of electricity has taken care of that.

At Cananea not only have the individual parts of the smelter been put into admirable shape, but the whole works has acquired a degree of efficiency that has probably placed it at the head of its class. The new ore-bedding system is the one feature that has made the combined result possible.

The use of the belt-conveyor does for the transportation of material almost exactly what the use of electricity does for the transmission of power. Distances, differences of elevation, or relative positions of buildings, otherwise seriously disadvantageous, become of little consequence. This ore-bedding system makes the use of the belt-conveyor practicable in the compounding and handling of blast-furnace charges.

The cars that bring the ore and flux to the smelter are unloaded into receiving-bins of moderate capacity, the chutes from which deliver the material to the first belt-conveyor of the series. These bins are only large enough to permit them to serve as an equalizer between the railroad and the belt-conveyor. They occupy a sufficient length of track to accommodate as many cars as must be unloaded at one time. On the way from the receiving-bins to the ore-beds the conveyor line is broken in order to pass the ore through crushers and samplers. Screens can be introduced with equal facility to divert the fine ore for separate treatment.

Over each bed there is a belt-conveyor equipped with a high-speed tripper, which distributes the ore continuously over the whole length of the bed. In this way the pile is made of uniform composition and physical character throughout its length. After the bed has been brought to the composition desired for the furnace-charge, the reclaiming machine attacks it from one end and sends the charge over another series of conveyors to the furnaces. The machine removes material from all parts of the cross section of the bed in a continuous manner. The remarkable results of the process are largely due to the uniform accuracy of the mixture delivered by the reclaiming machine.

The moving parts of the reclaiming machine consist of a harrow covering the whole face of the bed and gently moved back and forth, a chain of plows running on a steel plate at the bottom of the machine, and gearing arranged to advance the machine automatically into the bed. The reclaiming machines have been found to operate with great regularity on account of their extreme simplicity. From measurements of the wearing parts, after handling a large tonnage it is thought that the total cost of repairs on the machines will be between one-fifth and one-quarter cent per ton. The last conveyor deposits the charge in bins placed over the furnaces. From these it is drawn into measuring hoppers and from them falls directly into the furnace.

The accompanying photograph shows the appearance of the ore-beds during regular operation.

The first cost of three ore-beds of 10,000 tons capacity each, including reclaiming machines, is about one-half the cost of steel bins of the same capacity or three-quarters of the cost of timber bins. In operation, direct labor is eliminated. The cost of handling per ton is far lower than any previously realized with the exception of a small number of plants where there are only one or two classes of ore on the charge and where only one or two days' supply of ore is provided within reach of the furnaces.

The performance of the blast-furnaces is greatly improved. Irregularities calling for frequent changes in the charge for individual furnaces or all the furnaces of a battery, are now almost unknown. Charges of composition formerly impossible are easily smelted on account of the intimate mixture of the ingredients and the absence of unbidden chemical or physical variations. It is to be expected that when applied to lead smelting, the metallurgical as well as labor-saving advantages of this system will be even more striking than in copper practice.

Commercial Paragraphs.

The Murray Iron Works Co., Burlington, Iowa, builders of Corliss engines and tubular, internal-fired, and water-tube boilers, are open for a San Francisco correspondent.

A. G. Kirby and W. H. Shewan are erecting an ore-testing plant at Reno, Nevada, which includes equipment for amalgamation, concentration, and cyanidation.

The Hendryx Cyanide Machinery Co., of Denver, Colo., has recently received an order from the Tominil Mining Co., of Mazatlan, Sinaloa, Mexico, for a complete 50-ton mill, which includes crushers, rolls, tube-mills, agitation and filtration in Hendryx combination agitator and filter, and precipitation with zinc-dust. The cyanide equipment for 150-ton plant has also been sold to the Aguacate Mines Co., of New York, whose property is in Costa Rica, and a 20-ton plant to the Twin Butte Mining Co., of Clarkson, Washington.

On January 29, during the week the Sales Organization of the Western Electric Co. held its conference in Chicago, some of the old employees of the Chicago Organization gathered at luncheon at the Grand Pacific Hotel. Those who attended, and the dates they entered the employ of the

company, are as follows: E. W. Bennett, 1874; J. C. Cannon, 1877; F. B. Uhrig, now Western district supervisor of the company at Kansas City, 1881; D. L. Harmon, now a banker at Indiana Harbor, Ind., 1883; C. D. Wilkenson, manager of the Minneapolis house, 1886; Wm. Carpenter, of the Walworth & Neville Mfg. Co., who entered the employ of the Western Electric Co. in 1887; Rolo C. Hearsley, 1888; and E. S. Holmes, now manager of the Indianapolis house, 1890.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

GOLD: ITS GEOLOGICAL OCCURRENCE AND GEOGRAPHICAL DISTRIBUTION. By J. Malcolm Maclaren. Ill., pp. 687, 8vo. London: The Mining Journal. 1908.

This is an excellent book. The author, in his preface, apologises for adding "one more treatise to the literature of the study of ore deposits," but he need not have done so. Books so carefully prepared by authors as well equipped to write them are not numerous, even in economic geology. By his scholarly training, by his wide experience, and by his keen observation, Mr. Maclaren is well fitted to write a book on the geology of ore deposits valuable for gold. He has performed his task well, giving a book that every student will like to read and every mining engineer to possess. Part I is devoted to the general relations of auriferous deposits; this begins with a discussion of fundamental geological principles and then describes the known mineral compounds of gold. Then comes a classification of deposits into provinces, with a description of the principal goldfields of the world, followed by a compendium of observations relating to secondary enrichment, concentration in oreshoots, and other matters keenly interesting to the miner. Part II is entitled 'The Geographical Distribution of Gold'. This is a world-wide survey of the subject, and presents a useful summary of data concerning gold deposits in every region that is the scene of profitable mining. This part of the volume is well illustrated with sectional drawings of important lodes and by maps of many of the chief goldfields. The author is honest in reference and courteous in quotation, as becomes a scholar. He also exhibits the true scientific spirit in making no effort to speak conclusively concerning problems as to which conclusive evidence is lacking, contenting himself—and the reader—by stating the facts and as much theory as is warranted. The book is well printed and is a credit to the publisher.

LABORATORY EXPERIMENTS IN METALLURGY. By Albert Sauveur and H. M. Boylston. Small 4to., pp. 73, index. Cambridge, Mass. Published by the authors. 1908. Price $1.25.

The primary intention of this volume is to serve as a guide for instruction in laboratory practice; indeed, it would seem that its purpose were to inculcate method rather than to cover any field comprehensively. The illustrations of procedure to insure conditions leading to accurate results will undoubtedly point the way to similarly trustworthy methods in experiments not here specifically described. Nevertheless, a more extended treatise would be generally welcome, for such details of procedure are precisely what the text-books usually omit. For example, the volume before us will be of service to anyone having to do with calorimetry and pyrometry. There is a great deal of reckless pyrometry practised by men who should know better, but who have not had the minute details of procedure presented to them so that accuracy within the limits of instrumental error might be attained. The details given by Sauveur and Boylston on the use of the Mesuré & Nouel optical pyrometer, the Le Chatelier, and others, will be valuable. Also the method of determination of melting points is important. The work gives the procedure in proximate coal analysis, and then presents the heat treatment of steel in considerable detail. In that connection the ground covered is: magnetic properties occurring at the thermal critical points; relation between critical points and hardening power of steel; brittleness produced by hardening; effect of sudden quenching of high-carbon steel; effect of hardening on ductility, elasticity, and transverse strength; influence of variation of carbon-content; influence of nature of quenching bath; tempering of hardened steel; effect of annealing on cold-worked steel; effect of heat on grain of steel. It will prove suggestive and helpful as a laboratory assistant to those having in hand researches in fuels and steels.

MAP OF A PART OF NORTHERN MEXICO. Compiled by H. A. Horsfall. Four sheets, 9 by 12 in.; scale, 1 cm. = 20 kilometres, or approximately 1 in. = 32 miles. Price $2.

This compilation is exceedingly useful. It gives the most recent development of railroads and wagon-roads, and also shows trails throughout the area covered. In the details of railways and roads we have detected no errors. As much cannot be said for place-names, which have not been carefully edited. For example, on Sheet No. 3, we find Carbera for Cabrera, and Bacubrito for Bacubirito; on Sheet No. 4, Guadalupe de la Reys for Guadalupe de los Reyes, Conelas for Canelas; on Sheet No. 1, Tomochi for Tomóchic; and nearly all accents and tildes are omitted. Incidentally we may point out that if one should attempt to go by trail from Tamazula to Tepehuanes by the route indicated he would be three days longer than necessary on the road, and would have a sorry time of it; it would also be risky for a stranger to try to travel from Guadalupe y Calvo to Bacubirito, for instance, with no better guide than is here given. By these tests the trace of trails is not reliable. Otherwise the map seems in the main admirable, and it is certainly the best that can be obtained in compact form for the region covered, which stretches from Sierra Mojada and Presidio de San Vicente in the east to Guaymas and Mazatlán in the west.

COMPENDIUM OF USEFUL LEGAL INFORMATION FOR BUSINESS MEN. By B. A. Brennan. 16mo., pp. 571. New York. John Wiley & Sons. 1908. Price $5.

A practical succinct statement of the common obligations and powers under the law with regard to the ordinary business of life is a welcome addition to every man's library. No book can supersede the services of an attorney, but such a work as this will perform a useful service in warning the laymen of dangers and perils where, with the confidence of half-knowledge, he might have proceeded along lines that would have led to difficulties. The introductory chapters on contracts, sales contracts, property, deeds, mortgages, acknowledgments, power of attorney, and the like, will throw light on these subjects for the uninitiated. Of special importance is the extensive chapter on the Negotiable Instruments Law. Details of State law on ordinary commercial matters are given in considerable detail.

Catalogues Received.

THE J. GEO. LEYNER ENG. WKS. CO., Littleton, Colo., is distributing its Bulletin No. 1001, which is a series of reprints from the technical press dealing with modern methods of driving tunnels in hard rock. Numerous items on cost data are given.

THE WESTINGHOUSE ELEC. & MFG. CO., Pittsburg, Pa., is distributing an exceedingly attractive catalogue of fan motors. The cover is printed in colors and is a distinct departure from the usual machinery catalogue style. Complete dimensions and prices of all styles of fans are given.

THE ALLIS-CHALMERS CO., Milwaukee, has recently issued a list and index of the different bulletins and instruction books published by the company. It includes 187 pamphlets describing and illustrating prime movers of every description, electrical apparatus for alternating and direct current, pumping machinery, mining machinery, crushing and cement making machinery, flour mill machinery, and saw mill machinery.

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EDITORIAL.

WE are glad to state that Mr. H. Foster Bain, recently State Geologist of Illinois, will become one of the associate editors of this journal. Mr. Bain was formerly an officer of the United States Geological Survey and at another period he was in charge of mines in Colorado.

COPPER quotations are not affected adversely by the February statistics of the Producers Association because, although an increase of 28,000,000 pounds of the metal has been made during the month to the stock on hand, it is known that some large sales were consummated early in March, so that the position is not as bad as the statistics indicate.

IN our issue of February 20, we indicated the probable failure of the bill to create a Bureau of Mines. Unfortunately this expectation has been fulfilled, in the manner anticipated, namely, by abuse of that fiction called 'senatorial courtesy' on the part of Mr. Henry M. Teller, of Colorado, who expressed the irritation created locally by the Forest Service and desired to block the formation of any further bureaus likely to check unrestrained exploitation of natural resources.

BY the decision of the United States Steel Corporation to adopt the Heroult furnace, the refining of steel by electric smelting has been advanced to a position of industrial importance in America. The adoption of this furnace is an event encouraging to those who have been, for several years, experimenting with the electric smelting of the magnetite found in Shasta county, California. It will be a matter of moment to parts of the West, where water-power is readily available, when electricity, in lieu of coke, can be used in the reduction of iron ores.

OUR London contemporary, *The Mining Journal*, publishes a leader devoted to the relation of the Geological Survey of Great Britain to its mining industry, proving, in an excellent article, that the British Survey is devoted too much to the scientific, and too little to the economic, aspects of geology. Of this there can be no doubt, and we hope that the ventilation of the subject may lead to a recognition of the importance of a relation so admirably illustrated by the publications of the Geological Surveys of Canada, Australia, and the United States.

AN APPEAL for retention of the duty on lead was made in the House of Representatives by Mr. Burton L. French, in which he declared that "probably only two lead-producing mines in Idaho could pay operating expenses were the duty re-

moved," while the present wage-scale remained unaltered. In other words, the industry would collapse except when aided by the silver obtained as a by-product in the refining of the lead. As the precious-metal content is variable, this would render lead-mining precarious at all times in Idaho, in case the American market should be exposed to invasion from abroad.

ANOTHER organization of mining engineers has been formed. The latest expression of professional solidarity is the Mexican Mining and Metallurgical Institute, the first general meeting being announced for July at the City of Mexico. Mr. Bernard MacDonald is the leading spirit and he is supported by a number of representative men. The question of qualifications for membership is under discussion, with a suggestion on the one hand to copy the admission requirement of the American Institute and, on the other, to restrict membership to technical men. We wish this enterprise every success.

FRESH IMPETUS has been given in England to the search for radium owing to a recent lecture on its healing wonders by Sir Frederick Treves at the London Hospital. The stir it has occasioned in Cornwall has stimulated mining in a serious way. A similar spurt, some years ago, led to interest being taken in the pitchblende deposits in the St. Austell and St. Agnes districts, without, however, adding materially to the world's scant stock of this rare element. It remains to be seen whether or not the new movement is to result more favorably. At all events the experiment is creditable to the mining enterprise of the Duchy, and it will be followed with keen interest. Trewith, near St. Ives, is the mine presently commanding most attention, the capital (£40,000) to open which has been found privately by people who are known in connection with large financial firms, so that there will be no failure for want either of money or of intelligent direction in the spending of it. The concern is known as the British Radium Corporation Ltd. It is said that the total of this much coveted commodity hitherto won from nature scarcely amounts to ounces; this and the statement that pitchblende, the containing mineral, yields radium only in the same feeble proportion as there is gold in sea-water is certainly not economically encouraging though its least value is put at £20 per milligram. By existing arrangement all radium that may be obtained by this corporation from the pitchblende of Cornwall is to be retained in Britain. It will be sold to the Radium Institute of London, which has been called into existence on the initiative of the King. Among the results anticipated from these discoveries in Cornwall is a new development in photography. So strong is the luminosity of radio-active emanation that a piece of ore placed in front of an ordinary photographic plate in a dark room was found, after a short time, to have photographed itself. This effect, thus accidentally discovered, gives promise of a new branch of photography.

Calumet & Hecla Dominant.

The calumet has been filled and smoked. Peace has been declared by the big chiefs at the Boston pow-wow, and the quiet atmosphere that commonly prevails at 12 Ashburton Place will remain as of old. It was the heaviest storm that has assailed the Calumet & Hecla for decades, and the public refused to accept the celebration of peace with Mr. Bigelow as increasing the immediate value of the stocks of the great copper company, in spite of the longer life it has secured by the compromise just made. It was only three years ago that the Calumet & Hecla was credited with carrying liquid assets of seven million dollars; this year, when it adds 17,375 acres of copper-bearing lands with other notable assets at a cost of $8,500,000, it issues notes for $5,000,000. Truly, money is not as easy as it was. The copper producers may perhaps be selling their output as fast as it is mined, but the conservatives in Boston seem to consider the chances of dividends impaired by the assumption of such obligations in the form of a floating debt. Calumet & Hecla shares fell 35 points as a result of the transaction, and the so-called Bigelow stocks also suffered decline. The stock market concerns itself with prospects for immediate income. The expectations aroused by the long look ahead are reflected in the average price of a stable stock, but within a certain range of fluctuation the opinion of the market on the realizable profits as influenced by the current operations of a company are registered, as in this instance, by weaker quotations.

Yet no one can doubt the ultimate benefit to accrue from the absorption of the Bigelow properties. Mr. Alexander Agassiz is quoted as having testified that eleven years of production at the present rate would exhaust the orebody within the boundaries of the Calumet & Hecla lands. The statement seems incredible. We had reason to place the time-limit at 30 years. Even that is a brief period for a mine, when the selling price of its stock causes it to represent a capital of sixty-one million dollars. The actual capital-account of this corporation we understand to be only $1,250,000, all expansion and betterment since the mine began to pay having been met out of income and charged to operating expense. This is well enough for the original shareholders whose investment represented $12.50 per share, which shares have since yielded in dividends the splendid return of nearly $1000 each. To the purchaser of stock today at $610 the new shareholder participates in an enterprise that must theoretically, and actually so far as he is concerned, pay back a principal of $61,000,000, with profits.

The Calumet & Hecla has always been characterized by the extreme of conservative finance. It proposed to "attend to its own knitting;" the allurements of expansion were long in making an impression, and splendid opportunities were allowed to pass. In 1905 it secured an amended charter making it a securities and holding company as well as a mining corporation. As such it held 22,671 shares of stock in the Osceola Consolidated Mining Company, of which Mr. Albert S. Bigelow was president. The

right to vote this stock was contested by Mr. Bigelow on the ground of violation of the Sherman anti-trust act, a prior attempt to secure State legislation precluding one mining company from owning shares in another having failed. An injunction was issued, temporarily restraining the Calumet & Hecla from voting the stock, but the decision of Judge Knappen, when handed down, proved adverse to the contention of Mr. Bigelow. An appeal to the full bench resulted in sustaining the previous verdict. It was plain that the future of the Calumet & Hecla depended upon freedom to enlarge its holdings. This fact Mr. Bigelow understood perfectly. A threat of appeal to the United States Supreme Court was a good weapon with which to compel compromise. The original terms were deemed ridiculous; from what we can learn they were not far in excess of what Col. T. L. Livermore and Mr. Quincy A. Shaw, Jr., conceded in the end as being better than litigation and the possible loss of opportunity to expand. It was a wise concession. The Calumet & Hecla management has never been conspicuous for the application of the best practice in mining, but it has been successful. Measured by results it is open to no criticism that may not be dismissed with a smile. The Bigelow properties have achieved no equivalent record. At the Tamarack the cost of producing fine copper has varied from 11 to 13 cents, while its neighbor can go merrily on and make a little money at 9-cent copper on a pinch. It has done it in days gone-by. The fluctuation in the price of Osceola stocks, as the pendulum swung during the long controversy, reflected plainly the preference of the public for the management of the Calumet & Hecla. But Mr. Bigelow's name has been associated with successes, and eminent ones at that. It took a giant to whip the biggest mining company in the world into compromise. Even the Amalgamated could neither whip nor buy it. The seductive bid of $1000 per share produced no wavering. The Calumet & Hecla has stood alone, and has made its own policy; moreover it has succeeded regularly in realizing a larger average price per annum for its copper than its rivals.

By the adjustment now reached, Mr. Bigelow retires and will cease to be a factor in the mining affairs of Michigan. The properties absorbed are the Osceola, Tamarack, Ahmeek, Laurium, Seneca, and one-third of Isle Royale. The latter mine must not be confounded with the island of that name in Lake Superior. There has been copper mining on Isle Royale also, or a pretense at it, as some individuals in the East recall to their sorrow. There were some particularly innocent persons disappointed in a venture on that somewhat desolate and fog-bound island; some of them were literary gentlemen who could ill afford the cost of the experience. The Keweenaw syncline, with its copper-bearing conglomerates, reappears from beneath Lake Superior on Isle Royale, and the deposits may prove better than the early attempts at exploiting them would indicate. At any rate, rumor attributes to the Steel Trust the intention of entering the world of copper mining as a result of its acquisition of the holdings of the Isle Royale Land Corporation, Ltd., which comprise 83,720 acres on that island. But the Calumet & Hecla will not soon confront a rival in the Steel Corporation, even if the island mines prove favorable. As a result of the consolidation now effected the Calumet & Hecla will control at least 60 per cent of the output of Lake Copper, being nearly 12 per cent of the total copper yielded by American mines.

The Pearce Process.

Among the interesting papers recently published by the American Institute is a description of the Pearce process formerly in use at the Argo smelter, near Denver. This is contributed by Mr. Harold V. Pearce, the eldest son of Mr. Richard Pearce, the inventor of the process and the former manager of the works. It seems almost necessary to apologize for this explanation, for Mr. Pearce is so well known, honorably, almost affectionately, to most of our readers. He directed the operations of the Boston & Colorado works, as the Argo smelter was called, from 1878 until his retirement a few years ago. Visitors were shown the interesting features of an establishment that included examples of the turret roasting-furnace invented by the manager, the large reverberatory copper furnaces developed originally from Welsh practice, the Ziervogel process, in which silver sulphate is leached with water, the precipitation of the silver on copper, and of the copper on iron; but there was always one link in the process of reduction that was kept secret: What happened to the residues after the leaching of the silver from the roasted ore? Many were the guesses made by Egleston, Roberts-Austen, and other professors of metallurgy who visited the establishment. And some of them guessed shrewdly, for Mr. Harold Pearce explains that the gold was concentrated in copper bottoms, which were granulated and smelted with iron pyrite in a reverberatory. A further concentration was thus obtained, the solubility of gold being greater in metallic copper than in copper matte. These granulations were made until an alloy containing 10 to 20 per cent gold was attained. This was sent to the refinery, where the same process of concentration was advanced a further stage by repeated melting in crucibles, yielding a gold bullion, 920 fine, which was ready for the Mint. As Mr. J. W. Richards, of the *Electrochemical and Metallurgical Industry*, says, "the process depended on the 'distribution co-efficient' of the relative solubilities of gold in metallic copper and copper-iron sulphide and the ability to successively increase the mass of copper-iron sulphide by the addition of iron bisulphide." It is worthy of such dignified characterization; the Pearce process of gold refining as an incident to the smelting of copper ore was responsible for an output of 1,532,905 ounces of gold during a period of 30 years; for the process was applied at the little smelter at Black Hawk that was the predecessor (in 1873) of the Argo plant. When the refinery was burned in 1906, the management decided that it was inadvisable to re-build it, and thereupon the Pearce process ceased to be employed, its place being taken by the modern method of electrolytic refining.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

O. B. Perry is here.

T. H. Proske is at Denver, on his return from London.

F. Percy Rolfe has returned to London from Colombia.

Ralph Arnold, now at Washington, will shortly move to Los Angeles.

R. Gilman Brown, now in London, will proceed to Manchuria shortly.

Guy A. R. Lewington is on his way back to Dawson, Yukon Territory.

D'Arcy Weatherbe has been seriously ill with pneumonia at Rio Tinto, Spain.

A. C. Beatty was here, on a visit to the Stone Canyon coal mine, near Monterey.

John B. Farish is examining the Argonaut mine, in Amador county, California.

Edwin A. Austin has returned from Colombia, and will soon go to Dawson, Yukon.

D. C. Bard is at Placerville, Idaho, in the interest of the Globe Mines Exploration Company.

J. H. Mackenzie has returned to Goldfield, where he will remain for two or three months longer.

George W. Borrowe is at Cordoba, Vera Cruz, Mexico, where he expects to remain about one year.

W. E. Simpson has been appointed manager of the San Francisco del Oro mine, in Chihuahua, Mexico.

E. H. Nutter, lately superintendent of the Liberty Bell mine, in Colorado, is now at San Jose, California.

Alexander F. Reid, formerly metallurgist to the Montana Mining Co., has gone from Victoria, B. C., to London.

J. E. Woodman, of Dalhousie University, Halifax, has been appointed professor of geology in the University of New York.

Edgar H. Taylor, lately manager of the Boulder Perseverance, is now manager of the Lancefield mine, in Western Australia.

S. Walter Swing has resigned as general superintendent for the Cinco Estrellas Mining Co. and is at present on a trip to the East.

Robert Bell, former State mine inspector for Idaho, will become associated with John A. Kirby in the mining business at Salt Lake City.

F. H. Morley has returned to Denver from Jalisco and Oaxaca, Mexico, where he has been engaged in professional work for the Chicago Exploration Company.

Cortlandt E. Palmer has resigned as director and consulting engineer of the Esperanza company, to take effect April 1, after six years of continuous service.

The Pacific Coast division of the Mining and Metallurgical Society of America will meet at the Key Route Inn, Oakland, at 7 p. m. on the evening of March 13.

Owen Rice, manager of the Dives-Pelican and Seven-Thirty mines at Georgetown, Colorado, has resigned, to accept a position with the Lodi Mines Co., of Bob, Nevada.

Henry M. Adkinson, manager for the Gold Pioneer Mining Co., at Telluride, has also assumed the management of the Morning Star Mining Co.'s property near Ophir, Colorado.

Obituary.

Edwin Reynolds, one of the great mechanical engineers of the country, and for 30 years practical head of the Edward P. Allis Co., now the Allis-Chalmers Co., died at Milwaukee on February 19, at the age of 78 years.

Latest Market Reports.

LOCAL METAL PRICES—March 11.

Antimony	12@16c	Quicksilver (flask)	44@46
Electrolytic Copper	15¼@16½	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33½c

ANGLO-AMERICAN SHARES.
Cabled from London.

	Mar. 4. £. s. d.	Mar. 11. £. s. d.
Camp Bird	0 15 9	0 15 9
El Oro	1 3 9	1 3 9
Esperanza	3 2 6	2 16 3
Dolores	1 10 0	1 10 0
Oroville Dredging	0 10 6	0 10 6
Mexico Mines	4 15 0	4 15 0
Tomboy	0 17 6	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.
By wire from New York.
Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Feb. 26	12.37	3.80	4.70	50⅝
" 27	12.37	3.80	4.70	50⅝
" 28	Sunday.	No market.		
Mar. 1	12.43	3.80	4.70	50¾
" 2	12.50	3.78	4.72	50⅝
" 3	12.56	3.78	4.75	50¼
" 4	12.56	3.78	4.75	50⅛
" 5	12.56	3.96	4.75	50¼
" 6	12.56	3.96	4.75	50¼
" 7	Sunday.	No market.		
" 8	12.56	3.96	4.75	50¼
" 9	12.50	3.96	4.75	50⅝
" 10	12.50	3.96	4.75	50⅜
" 11	12.50	3.96	4.75	50⅜

SOUTHERN NEVADA STOCKS.
San Francisco, March 11.

Atlanta	$ 11	Midway	21
Belmont	87	Montana Tonopah	70
Booth	19	Nevada Hills	1.35
Columbia Mtn	11	Ophir	1.00
Combination Fraction	1.00	Pittsburg Silver Peak	70
Daisy	51	Rawhide Coalition	62
Fairview Eagle	10	Rawhide Queen	40
Florence	3.45	Round Mountain	80
Goldfield Con	7.55	Sandstorm	10
Gold Kewenas	15	Silver Pick	7
Great Bend	17	St. Ives	15
Jim Butler	17	Tonopah Extension	70
Jumbo Extension	12	Tonopah of Nevada	6.62
MacNamara	24	Tramp Con	6
Mayflower	17	West End	33

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Mar. 4.	Mar. 11.
Amalgamated Copper	67⅛	68⅜
American Smelting & Refining Co.	80¾	83
Boston Copper	12	11
Butte Coalition	23	23
Cumberland Ely	7¾	7¾
Dolores	5¾	6
El Rayo	2⅝	2⅝
Giroux	8¼	8¼
Greene-Cananea	9⅞	9⅜
Indiana Sonora	3¾	3¾
La Rose	6⅜	6⅜
Miami Copper	13⅜	13¼
Nevada Consolidated	17⅛	17⅝
Newhouse	4⅛	37⅛
Nipissing	9¼	10⅞
Ohio Copper	6¼	7⅜
Tennessee Copper	37¾	40
Utah Copper	41	41
Yukon	4¼	4⅜

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. March 11.		Closing prices. March 11.
Adventure	7½	Mass	5
Ahmeek	140	Mohawk	62½
Allouez	38½	North Butte	69
Arcadian	5	Old Dominion	48
Atlantic	14½	Osceola	129
Calumet & Arizona	99	Parrot	30½
Calumet & Hecla	627	Santa Fe	2⅛
Centennial	29	Shannon	14
Copper Range	76⅛	Superior & Pittsburg	14¾
Daly-West	9½	Tamarack	80
First National	——	Trinity	11
Franklin	13¼	United Copper Con	12
Granby	94½	Utah Con	40½
Greene-Cananea, ctf	9¼	Victoria	4¾
Isle Royale	27½	Winona	6
Lake	17	Wolverine	147

(By courtesy of E. F. Hutton & Co., 490 California St.)

General Mining News.

ALASKA.

(Special Correspondence).—The Western Federation of Miners has issued an official circular calling attention to the fact that there is a strike on in the Nome district. This is in response to the wholesale hiring of Russian Cossacks, Greeks, and Laplanders by the Pioneer Co., which is working more men than all the other operators combined. As a consequence labor conditions are still unsettled, for laborers are scarce and the winter's output of placer gold will be sensibly less than last season. One operator is offering $4 per day and board to competent non-union men.——At Fairbanks, on the other hand, there is abundance of labor, and a boom in quartz mining, with $5 per 8-hr. day as the established scale of wages.——The recent gold quartz strike reported on the Koyukuk river turns out to be on the Koyuk, and is 150 miles up the river on two small tributaries of that stream, just across the divide from where the Parantulik river empties into the Fish river. Rich samples of the ore have been brought out by prospectors who have arrived in Nome.——A new find of placer diggings is reported from Gold Hill, a new camp near Hot Springs.——On Sullivan creek two laymen are blocking out a huge pay-streak that is said to average an ounce of fine gold per ton. ——Coal in Nome this winter costs $20 per ton inside the city limits, and $5 to $7.50 additional per ton on the adjacent creeks; flour $5.50 per 100 lb.; eggs $1 per doz.; potatoes $4 per case; apples $2.50 per case; beans 8c. per lb., and bacon 25 to 35c. per lb.——A party of prospectors left Fairbanks on December 30 for the Tatalina district, and two days after a stampede was started for the scene of a supposed strike on Tatalina river, which is a tributary of the Tolovana. The stampeders, about forty in number, have located all of Washington creek and about six or eight miles of the Tatalina, above the mouth of Washington creek. This report was confirmed by telegraph from the Government Station at the mouth of Tolovana river, 117 miles above Fort Gibbon.——Twelve new camps have been started since Christmas the lessees of which are members of the W. F. of M. at Nome. The local miners are said to be financing these operators and providing them with union labor to prevent 'open-shop' methods of the anti-union operators.——The Westinghouse Electric Co. is reported to have purchased the Chicago creek coal mines near Candle, for generating electric power to transmit at 60,000 volts to Nome. This power is to be used in operating sea-pumps for ground-sluicing a vast area of graveled tundra into Bering Sea. The project is one of the most gigantic mining enterprises ever attempted. It will be capitalized at $60,000,000, and will include the purchase and operation of 18,000 acres of placer-ground around Nome, besides the Nome Sinnook Mining Co.'s ground, covered by the Nome Townsite patent on which the city of Nome is built.

Nome, January 15.

ARIZONA.

COCHISE COUNTY.

The Fink silver property on Silver creek has been bonded by the owners, Albert Fink and Shaw Bros., to S. S. Suplee and J. P. Ewart, of Douglas. The sale price agreed upon is $25,000, under terms covering a period of 18 months. The Fink group consists of three full claims and a fraction, situated in the foothill belt about three miles east of Paradise. The shaft, long since abandoned, will be timbered and made ready for production.——A gasoline hoist has been installed on the property of the Bisbee Extension Co., and a 2-drill compressor is being put in. A pipe-line has been completed for the purpose of conveying water for the underground operations and is now ready for the water to be turned on. Drifts are in progress on the 400-ft. level, to reach an orebody exposed on a level above.——The recent strike of a large body of ore on the 700-ft. level of the Tombstone Copper Mining Co.'s property is considered very encouraging, as this is 200 ft. below the water-level of the region. The 40-stamp mill is working regularly, and despite the great volume of water with which the company had to contend before the big pumps were installed, there is now no difficulty in handling the water, about 6,000,000 gal. per day being taken out of the shaft.

MOHAVE COUNTY.

The Tom Reed Gold Co. is bringing in much lumber for the development of its mine. The main shaft is being sunk rapidly, and will be hastened when the compressor is in place. This is now on the ground, and will be able to run 18 drills.——The Golconda mine is shipping zinc ore to the smelter, and the mine is improving with depth. In the winze from the 100-ft. level there are three feet of clean zinc ore running above 50 per cent.

PINAL COUNTY.

Plans are under way for the consolidation of the Eureka mines with the Globe Consolidated under the name of the Cordova Copper Co., with a capitalization of $3,000,000.

YAVAPAI COUNTY.

The Vulcan Copper Co., operating in the Jerome district, is ready to start two shifts on its property in Deception gulch. Joe Larsen is superintendent.——The Verde Grande Copper Co., near Jerome, has pulled its pumps and ceased all work. The manager states that he does not know when work will be resumed.——The Arizona Power Co., installing a plant on Fossil creek to develop electricity by water-power, reports that the power-house is completed and one of the three big generators is now in place. The towers are set and the transmission lines have been strung to Jerome. The Jerome sub-station will be ready for business by the latter part of April. Present contracts with the company call for the delivery of 1500 horse-power.

CALIFORNIA.

AMADOR COUNTY.

The Argonaut Mining Co. has been reorganized. The holding company of the Argonaut, the Argonaut Consolidated, was represented by A. H. Carlyle, Jesse W. Lilienthal, E. A. Stent, J. H. Tam, and John Raggio, of Stockton. A board of directors for the year was elected, including J. W. Lilienthal, E. A. Stent, John Raggio, R. S. Rainsford, and B. F. Taylor. J. W. Lilienthal was elected president, B. F. Taylor vice-president, E. V. Zumbiel secretary, and R. S. Rainsford superintendent. The development of the property will proceed steadily.——The shaft of the old Central Eureka mine, has been repaired to within 400 ft. from the bottom of the mine. The company intends, so it is reported, to develop to greater depth. Some assessments may be necessary to get the mine upon a working basis.

INYO COUNTY.

J. W. Rossi is developing his prospect in the Sierra foothills about three miles south of Keeler. Assays of surface rock give returns up to $12 per ton. The vein was discovered by trenching, cutting the ore at three or four feet underground.

KERN COUNTY.

(Special Correspondence).—The Knickerbocker Mining & Extraction Co. has taken over the Edith and four other claims, and is arranging to work the holdings on a systematic scale. Machinery has been purchased and a force of men will be put to work at once. The main vein is 3 ft. wide and runs about $25 per ton in gold. Joseph McNight is president and manager.——A gold-bearing vein with tungsten ore is said to have been discovered by J. D. Feris in his claim in Caliente canyon.——A new 10-stamp mill has just been completed at the Zenda mine, under bond to Johnson & McCarty. A tram-line has also been completed from the mine to the mill and arrangements are being perfected for operating on a large scale.——Johnson & McCarty have taken a bond on the Pearl mine and are about to commence active work. A 40-ft. vein carrying fair ore has been opened up and will be treated at the Zenda mill. ——At the Amalie mine the shaft is down 500 ft. and about 50 men are on the pay-roll. The low-grade ore is treated by a Huntington mill and the high-grade is shipped to the

Selby smelter.——The Gold Peak mine is practically idle owing to the large volume of water encountered, and other unsatisfactory conditions.——The shaft at the Atlas is down 150 ft. The vein runs from 3 to 6 ft. wide and assays about $20 per ton.——It is rumored that a New York corporation is considering the installation of an electric smelter at Paris to treat ore from the numerous properties in the district.

Bakersfield, March 6.

MONO COUNTY.

A new copper and gold camp, situated near Gardnerville, may come into prominence. Four properties are producing ore in the new camp, some of which is reported to have run as high as $36 a ton. The name of Crystal City has been adopted for the camp. The country has been staked out for three miles.

NEVADA COUNTY.

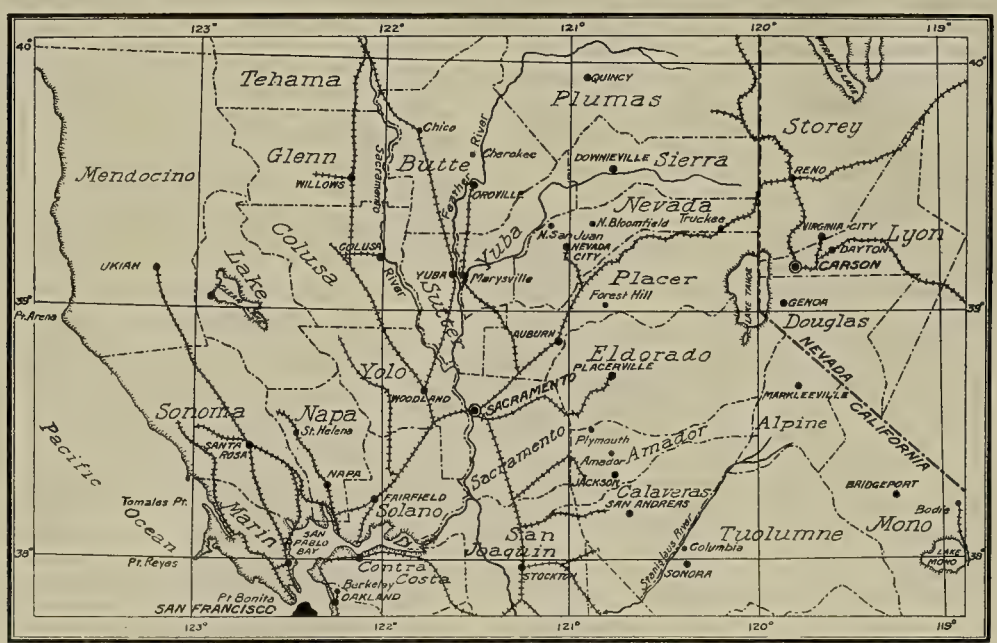
The orebody on the 1400-ft. level of the Pennsylvania mine continues to show up well. Considerable good ore has been recently taken out. Over 100 men are employed and the mill is running steadily. Bennet Opie is superintendent.——A rich pocket of ore has been found in the Greek vein at Union Hill. The mine is showing up splendidly and several men have been recently added to the payroll. Clifford Graham is manager.——At the Empire the 40-stamp mill is running at full capacity and extensive work is going forward in the upper and lower levels. It is understood that the monthly production is considerably over $50,000. As soon as the new plunger pumps have been installed sinking will be commenced.——Several rumors are afloat to the effect that work will be resumed this summer at the Allison Ranch mine. This famous property has lain idle for several years, although highly regarded by local mining men.——The mill at the Sultana is working steadily and fair-grade ore is being treated. A large force of men is employed and considerable development work is being done.——The adit at the Belle Union is approaching the vein. Some promising ore has been discovered and a test will be made at the Southern mill, which is being placed in shape for active work.——At the Mountain View developments are being actively pushed. Stoping will soon commence. It is expected to have the new mill erected during the coming spring. E. B. Miller is superintendent.——The Hamilton brothers are sinking a shaft in the South Lindsay mine at a point 350 ft. along an adit they have driven to cut the vein. This shaft is at present 16 ft. deep, and has disclosed ore more than 9 ft. wide, most of which is of good milling grade. The mine is situated at Maybert, on the South Fork of the Yuba river.

SIERRA COUNTY.

The management of the Snowdon Hill mine is making a large gravel dump and putting in a flume in anticipation of soon striking the channel. The adit is now in nearly 250 ft., and when another hundred feet is run, probably in a little over a month, a raise will be put up into the gravel.——Several men have been laid off at the Papoose mine. There is abundant rock in sight that will mill $4 and $5 per ton, but as the sulphides are of the greatest value, and as yet there are no concentrators in the mill, it was thought best to put in concentrators at once. Some of the machinery is now at the mine and the rest in Sierra City. The remaining parts will be hauled to the mine and put in place this week.

TRINITY COUNTY.

C. E. Goodyear, general manager of the Union Hill mine, reports satisfactory conditions at the mine and with the ditches. These are now running full of water, and he has three monitors playing on a gravel bank over 600 ft. in width.——It is reported that a good strike of sylvanite has been made at the Yellow Jacket mine in the East Fork mining district.



Map of Central California.

TUOLUMNE COUNTY.

Operations were resumed last week at the Driesam mine. The temporary cessation of work was caused by the caving of a drift on the 200-ft. level, the mushy falling ground running into and partly filling the shaft.——High-grade ore has been found on the 2200-ft. level in the Eagle-Shawmut mine. The ore is of such unusual richness as to have caused the management to decide to continue sinking the shaft.——The Bonanza mine, situated within the limits of the city of Sonora, is to be worked again. Preparations for re-opening the mine are now under way, and in a short time active work will be commenced.——The Nave-Musso mine, near Jacksonville, have been bonded to A. W. Copp, and active work will be commenced soon. The ore assays $14 gold per ton and carries 2% sulphides that assay $492 per ton.——The shaft at the Jubilee mine is being retimbered, preparatory to resuming active work.——It is reported that a valuable strike was recently made in the Arbona mine at Tuttletown.——There is an unusual stillness at the property of the United Mines Corporation, due to the company's failure to pay its employees on March 1,

the majority of whom are owed three months' wages. As a result of the company's failure to meet its obligations, liens and attachments aggregating several thousand dollars have been filed against the property. It is understood that a dispute between some of the stockholders led to the present state of affairs. It seems to be the general belief, however, that the property will not remain idle long.

COLORADO.

BOULDER COUNTY.

The Ward Gold Cyanide Milling Co. has broken ground for the foundation of a mill which will treat custom ore as well as the ore from the company's own property. The mill will be situated on Indiana creek within a short distance of the railroad running from Boulder to Ward.

TELLER COUNTY.

The output from the Cripple Creek district for the month of February is valued at $1,145,204, or about $200,000 less than January. The tonnage for the month was 52,716, being 9000 tons short of January. This is explained by the fact that the Wild Horse and Copper mine cyanide mills were closed down during the entire month and that February had three days fewer than the previous month.

IDAHO.

SHOSHONE COUNTY.

(Special Correspondence).—Shaft-sinking in the Caledonia mine at Wardner has been stopped for a few days on account of the heavy flow of water. An electric pump with a capacity of 500 gal. has been ordered and as soon as this is installed work will be resumed. In the meantime the drift is being advanced, and from 20 to 50 sacks of ore daily prepared for shipment.——Upward of 1000 sacks of high-grade ore have been sorted and are ready for shipment from the St. Joe Quartz Mining Co.'s property. It is expected that regular shipments will be made throughout the summer.——Operations have ceased at the Galena property at Burke, and the workings of the mine have been boarded up. A small fortune has been spent in development, and recently a shaft was sunk to the 600-ft. level. A considerable amount of drifting has been done, but the showing is said to have been disappointing.——Work on the Hidden Treasure mine in the Lane district has been stopped pending the installation of pumping and other machinery. The whole bottom of the shaft is in mineralized matter showing a stringer of 14 in. of good galena.——The car of ore which was recently shipped to the smelter at Tacoma from the Mineral Point property in the Osborne district has been declared to contain 174 oz. silver, 3.7% copper, 37% iron, and 21.9% silica. It is expected that shipments will be made at regular intervals.——Ben E. Hervey, of Spokane, who took an option some time ago on the property of the Four Ledge Mining Co., has just made the final payment of $10,000. The property has been well developed and an excellent showing made in all the workings. A contract for 100 ft. of work has just been let to Hugh Mabin and others.——The first cross-cut from the foot-wall to the hanging wall in the drift of the Amazon-Dixie mine in the Lookout district has opened up about 18 ft. of good-grade milling ore, and the hanging wall is not yet in sight. The depth is about 200 ft., and the ore assays from 6 to 10% lead. Arrangements are being made by the company for the use of the Leslie compressor during the installation of their own plant.

Wallace, March 4.

KOOTENAI COUNTY.

The Copper Prince Mining Co., in the St. Joe district, intends to erect a hotel to cost about $5000, the upper portion of which will be for the accommodation of miners, while a regular hotel busines will be conducted on the lower story. In addition to this the company will install a 10-drill compressor and a flume over a mile long. The company owns 12 claims and has a good showing of ore.

KANSAS.

CHEROKEE COUNTY.

The most important recent work in the Galena camp is the draining of Short Creek bottoms, which was once one of the most famous of Galena's producing tracts. Unusual interest is being taken in the work because it is known to contain rich ore, and old-time miners are hastening to secure leases upon the land. The pumps have now been started and the water is slowly receding. It is thought that it will be only a short time before work can be resumed in the upper levels.

MICHIGAN.

Superior & Boston is now shipping an average of 70 tons of ore daily from the Great Eastern shaft. John H. Rice will be in Globe this week and it is possible an announcement will be made as to the disposition of the Collins-Doyle tract which is optioned to Superior & Boston.——It is possible that Calumet & Hecla will resume exploratory work on the Delaware property next spring. The company owns an immense tract upon which only a little exploration work has been done. It is understood that two diamond-drills will be utilized.——The drift on the thirteenth level of Keweenaw is being driven at a rate that will disclose the west fissure-vein within a few days. This vein carries an encouraging amount of copper where tapped on the level above. The company is milling about 110 tons of 'rock' daily.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—The Trinity mill at Porto Rico has started operations after a period of several idle months, caused by low ore-prices and the litigation in which this company has been involved. This plant is almost new and has a capacity of 500 tons. It works upon sheet ground similar to other properties in the vicinity.——Plans are under way for the installation of centrifugal pumps on the Lone Elm Hollow tract, northwest of Joplin, to drain this old camp which was once the centre of mining in Joplin. ——Activities are noted in the Zincite camp, where some large pumps have been installed by Gundling & Maitland. The water has already been drained from the shallow workings, so that a number of old leases have re-opened and are working down to the 80-ft. level.——The Victoria mine in this camp is again producing after battling for some time with heavy water which became almost unmanageable when new prospecting was undertaken. It is a good producer and has again been able to place its name on the weekly production list.——Two large calamine producers have attracted the attention of the camp. On the Hall and south of Duenweg over $40,000 worth of ore has been taken from less than one acre of ground in the past year. The ore was first taken from the 90-ft. level, but ore was also found in the bottom of the mine, and sinking was continued below the 100-ft. level. Prospecting reveals a large acreage underlaid with the splendid deposits, whose extent is unknown, but is sufficient to last many years. The ore is the best grade of its kind and brings the top market price.

Joplin, March 5.

MONTANA.

FERGUS COUNTY.

Twenty-eight tons of ore from the Cumberland mine at Maiden, of which Peter Rosse is superintendent and part owner, netted $7159 at the Panhandle smelter, where it is reported to be the richest ore yet handled at the plant. The ore was hauled 20 miles by team and then shipped by rail to Idaho. The Cumberland was discovered by Rosse, who four years ago obtained R. M. Calkins and Oscar Stephens as partners. It was being developed when the sudden death of Stephens put a stop to the work, and it has only been pursued at intervals since.

NEVADA.

ESMERALDA COUNTY.

The Goldfield Miners' Union, at its recently held semi-annual election, selected Owen Barnes as president; David Schultz, vice-president; J. J. Mangan, secretary and treasurer, and Chris. Dutler, recording secretary. J. J. McMahon, William Agan, and John Donald were elected to the committee on finance. A. L. Anderson, Joseph Hamil-

ton, and Richard Egan were elected as trustees for the next six months, while Angus McMillan was chosen as conductor, and Emil Tennant as warden. Four hundred and fifty-one ballots were cast.——The annual report of the Pittsburg-Silver Peak Gold Mining Co. at Blair is being received by stockholders and announces that during the year 1908, 105,670 tons of ore were treated in the company's mill. The bullion receipts amounted to $848,713, while the operating expenses were $499,789, making the net earnings $348,932. The report states that the plant has given complete satisfaction and that all imperfections have been remedied. The mill has been operating on an average 93.1 stamps during the month of January 1909, the balance being held in reserve for emergency use.——The ore tonnage treated and shipped from the mines and leases of Goldfield district during the past week, according to the *Tribune*, amounted to 5975 tons, valued at $226,700. A total of 685 tons of gold ore was received by the Nevada-Goldfield Reduction Works, the average grade of which was about $40. Included in the total was a shipment of 405 tons from the Combination Fraction. There also was one carload of 50 tons from Pioneer that ran $4500. The Consolidated—at both mills—treated approximately 600 tons of ore each day that probably averaged about $40. This gives a treatment of about 4200 tons to the week, representing a value in the neighborhood of $168,000. The Florence has thirty stamps running and is turning out about 840 tons per week of ore that will mill, as a rule, about $20 per ton. The Western Ore Purchasing Co. sent out about 200 tons by the railroads.

HUMBOLDT COUNTY.

(Special Correspondence).—The Seven Troughs district has now been proved for a distance of 12 miles along the mineral belt. Development work is active throughout the whole length, and some bullion is being produced.——The Seven Troughs Mining Co. received a $13,000 draft last week for bullion sent to Carson City, obtained from a 10 days test-run of ore through the Kindergarten Co.'s mill. This mill is now treating a 100-ton lot of Wihuja lease ore, from the Seven Troughs Coalition estate. Wihuja ore averages $80 per ton, aside from the high-grade, which assays $20 per pound. The Florence lease, on the Seven Troughs estate, is fast developing into the greatest mine in this rich district. They have taken out over 100 tons of ore during the progress of development work, averaging $80 per ton. This ore comes from a vein about 5 ft. wide, cut by stringers of high grade, and shows every indication of great persistence. The deepest workings on the company's estate are now 750 ft. down, and are still in ore, all production of which is sent to the Kindergarten mill. Other smaller properties, but of hardly less importance, are also doing famously.——The Big Dipper, adjacent to the Seven Troughs, shows free gold in a 2-ft. vein which assays over $50 near the surface.——One hundred thousand shares of Seven Troughs Coalition stock have been sold recently at par, giving some idea of the local esteem in which the property is held.——The Mazuma Hills Co. received $1500 recently from a clean-up in the company's mill of 125 tons of ore. The mill is now treating ore from the Reagan lease, a rich producer on the same estate.——The mill on the Badger Hill group of claims averages a clean-up of over $1000 per week.——Three mills are in successful operation, and the fourth is expected to be ready early in April; further, plans have been made for the construction of two more. Altogether the Seven Troughs and Vernon districts have every reason to congratulate themselves.

Vernon, March 6.

LANDER COUNTY.

The Austin-Manhattan Consolidated Mining Co. of Austin has almost completed its 6000-ft. drainage adit connecting the mill with the bottom of the Frost shaft. A cross-cut 2800 ft. long from this adit has been cleared out, and the Isabella shaft opened to the 600-ft. level preparatory to mining the ore of milling grade.——The Hardy property is being developed by a drift on the vein, which is 5 ft. wide at the 50-ft. level, and assays $20 per ton, chiefly in gold. The present 30-stamp mill will be re-modeled to treat the ores more efficiently. For power the company expects to use California fuel oil in large units of Diesel engines.

NYE COUNTY.

The Nevada-California Power Co. is to build at once to Round Mountain and Manhattan. The company, under the terms of its agreement should have a full power service installed by May 15. Most of the mines in the district are down to a depth which makes gasoline power costly and, in some cases, impossible. The mills now operating in these camps have been using steam-power, but with wood costing $8, and often more, per cord, the question of economical power became an acute and pressing one for them.

Four hundred and seventy-five votes were cast at the election held by the Tonopah miners' union. The closest contest was that for president, Frank Darrah being defeated by M. J. Scanlon by eight votes. Other officers elected for the year include J. P. Murphy, vice-president; P. A. Lee and R. H. Ralzell, secretaries; and Dennis Murphy, conductor.——The 40-stamp mill of the Montana Tonopah Co. crushed 757 tons of ore from the company's mine and 233 from the MacNamara, a total of 990 tons, returning an average extraction of 89.4%. A total of 228 ft. of development work has been done, which is in excess of any week's record for some time past. The new refining plant is working well, and produced 21 bars of bullion as the result of the half monthly clean-up.——Preparations are being made to unwater and clean out the old Belmont shaft. A sinking pump and small hoist are on the ground, and a pipe-line to convey air for power is being laid. No trouble is anticipated from water, as the cross-cut on the 1000-ft. level, fully 400 ft. deeper, is absolutely dry. When the cleaning of the shaft has been completed a 6-inch churn drill-hole will be put down to connect with the cross-cut on the 1000-ft. level, requiring about three weeks' time. A raise will then be started from this cross-cut on the 1000-ft. level, and when the bottom of the present 2-compartment shaft is reached, the latter will be enlarged to 3-compartment.——During the past week a change in the superintendency of the Jim Butler has taken place. Alex Johnson, who has been the superintendent of the mine for the past 15 months, has resigned, and S. H. Brady, of the Belmont, has been chosen to fill his place. There is no change to note in the appearance of the various stopes this week, the usual output of 300 tons having been extracted and sent to the mill. ——The work being done at the end of the 400-ft. level in the extreme westerly workings of the Tonopah Extension Mining Co. is proving an excellent body of ore, showing a width of over 10 ft., all of which is of good milling quality. Raise No. 3, near the boundary of the Tonopah Mining Co., has been advanced 40 ft. in ore all the way. The vein at this place is in two streaks, aggregating 10 ft. in width, being separated by about two feet of porphyry.——The Pioneer lease has started shipping ore from the 210-ft. level. About ten days ago the ore-shoot was reached, and the interval has been consumed in an effort to prepare the ground for smooth production. A 6-drill compressor is expected next week, together with a 60-hp. engine.——The Mayflower mill was started this week and christened with a bottle of champagne. Considerable trouble was experienced at first in the mill by reason of faulty and unadjusted pumps. By Thursday these difficulties had been overcome, and on that day the plant was running smoothly.

WHITE PINE COUNTY.

E. W. Walter, who for the last two years has been general manager of the Giroux Consolidated Mines Co., has left Ely and will go to Hillside, Arizona, where he becomes manager of the Copper Creek Copper Co.——The Nevada Consolidated and the Cumberland Ely Copper companies, which jointly control the Steptoe smelter, have just put into commission a third reverberatory furnace.——It is reported that the power-plant at the Giroux Consolidated mines will be augmented and that large pumps will be installed in the Alpha shaft. Good ore is opened up in the Alpha, Monster, Bunker Hill, Brooks, Morris, and Old Glory shafts.——Considerable impetus has been given to the mining industry in the Ely district by the reports of the early

construction of the Ely-Goldfield railroad.——The lead and silver mines are commencing to attract attention and it is likely that considerable work on these properties will be pushed during the summer.

NEW MEXICO.

GRANT COUNTY.

The enthusiasts of Sylvanite declare that all their ore exceeding $15 per ton can be shipped at a profit. The rate for hauling ore to Hachita is $2.50 per ton. Transport to the Douglas smelter for ore worth less than $50 per ton is $1. When ore carries 75% silica or less, the smelting charge is $2 per ton. If over 75% a premium of 15c. per unit is paid, and most of the Sylvanite ore falls into this class.

The Gold Hill mine continues to develop most satisfactorily, and two shifts of miners are employed in both the east and west adits. The west adit is now in 160 ft. and has to be driven about another 60 ft. to strike the ore-shoot opened in the upper workings.——The directors and management of the Monte Cristo Mining Co. are so much encouraged by the result of the first shipment from the Pearl mine that a second consignment is now being prepared.

SOUTH DAKOTA.

CUSTER COUNTY.

(Special Correspondence).——Two new veins have recently been discovered on the property of the Saginaw Mining Co., one of which, east of the mill, shows gold to the extent of $6 to $15 per ton; this vein is about 8 ft. wide, and is being largely drawn upon as supply for the mill. The company's mill treats 50 tons per day, and is well equipped for cyaniding. J. W. Herber is manager.——The Ideal Mining Co., of which A. N. Connor is superintendent, is making slow progress with the erection of its mill on account of the bad weather. Connor announces that a full force will soon be employed in both mine and mill.——The New York and White Spar mica mines, belonging to the Westinghouse Electric Manufacturing Co., situated 6 miles west of Custer, has partly closed down for the present, while they are changing machinery and erecting new houses. Joseph Payne is superintendent at the mine.——The 10-stamp mill at the Ruberta has not yet been started, principally on account of trouble with the Forest Service. The company has been forbidden to take timber from one of the claims in its group to be used at the mine and mill which are situated on another claim of the same group.

Custer, March 5.

UTAH.

BEAVER COUNTY.

The Cactus mines of the Newhouse Mines & Smelters Corporation ceased production on the first of the month. T. R. Drummond states that during the six weeks or so that the mill will be undergoing changes, the work underground will be reduced to that of about 30 men kept on development. It is expected to get under way again about the middle of April, and then treat an average of about 25,000 tons of ore per month.

SALT LAKE COUNTY.

A deal is on foot at Bingham whereby the Butler Liberal, Utah Apex, and the Red Wing properties are to consolidate and be called the Utah Northern. It is said that there are English and Scotch capitalists behind this consolidation.——Stockholders of the Boston Consolidated Copper Co. have been asked to authorize the issue of 50,000 shares at $11.25 per share. It is said that the new issue is to meet floating dept, due to drawing on copper when the price was much higher than at present. Then there was trouble at the mine when it temporarily became necessary to abandon steam-shovels, and there has also been much delay in getting the mill into commission. All of which accounts for the poor position in which the finances of the company now stand.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—The last carload of ore shipped by the New Republic Mining Co. went to the Granby smelter, at Grand Forks, B. C. Its gross value was estimated by the management to be about $15,000, or $357 per ton. The company is now employing 54 men and expects to slightly increase the force in another week. The new machinery for the mine is reported to be at the railway depot and will be delivered and installed without delay. It consists of a Fairbanks-Morse 5-drill air-compressor, a 25-hp. electric hoist, a 3-phase dynamo, 3 St. Clair air-hammer drills, and 1 heavy piston-drill. The compressor has a capacity of 355 cu. ft. of force-air per minute at this altitude, and it will be installed close by the hoist and drill-sharpening machine. At the first regular meeting of shareholders there was elected an executive committee consisting of L. W. Anderson, J. L. Harper, and J. E. McFarland.

Republic, March 5.

LEWIS COUNTY.

The little village of Mayfield has been enlivened during the last two months by the staking of numerous claims by prospectors and by the farmers of the region. The main belt of ore is said to run in a southeasterly direction across the Cowlitz river and across Winston and Salmon creeks for a distance of eight miles. It is essentially low-grade and free-milling, but no gold is visible without assaying. William Harper was the man who made the first discoveries, and George Robinson, of Chehalis, has taken them up with considerable activity.

STEVENS COUNTY.

In the adit of the Copper Cliff mine, near Chewelah, ore was discovered unexpectedly 162 ft. from the portal, and several stringers have since been cut. The property will be incorporated, with Chicago and Seattle people holding the controlling interest. The working force will be increased and the adit advanced to the 300-ft. point, where it is expected the main vein will be found.

CANADA.

BRITISH COLUMBIA.

The Consolidated Mining & Milling Co. has obtained from J. P. Swedburg a 30 months bond on the Queen Victoria mine at Beasley, eight miles west of Nelson. The property is equipped with the most modern machinery, and shipments will be made almost immediately to the smelter at Trail. It is a low-grade copper property, carrying much lime, which adapts it for mixing with the Rossland ore as flux.——An official of the Grand Trunk Pacific has been expressing surprise that the region opened by the new railroad is as yet not attracting much attention from prospectors; but he says that in the Babine range, drained by the Peace river, a good many claims have been staked, and there are indications of copper, silver, and gold. Furthermore, the bed of the Peace river shows black sand, and quite sufficient 'colors' to induce further prospecting. Unlike many of the streams of the southern part of the Province, the bars of the Peace river are almost entirely free from boulders, which would greatly favor the possibility of working them with dredges.——L. R. Broadbent, of the Dominion Geological Survey, is collecting British Columbia ores for the Alaska-Yukon-Pacific Exposition.

MEXICO.

TEPIC.

The Tepic Gold Mining Co. has been organized in Los Angeles, with a capital of $300,000, to take over and work the Certuchena y Anexas gold mines. S. W. Garretson is president of the company, C. M. Shannon vice-president, and J. W. Roberts secretary. The mines were purchased a few months ago from Lonergan & Stanhope, an English firm of Tepic, for ₱50,000, the deal being made by Marshall P. Wright, of Los Angeles. There is a small reduction plant at the mines. The plans of the new owners call for modern reduction facilities, and the installation of a hydro-electric plant about five miles from the property. The construction of the Southern Pacific extension through Tepic will place transportation within five miles of the Certuchena mines.

Special Correspondence.

DENVER, COLORADO.

New Processes —Dredging.—Tungsten Mining.

New metallurgical methods of treating ores are receiving much attention at present in Colorado. The management of the Portland Mining Co. at Cripple Creek believes that it has found a method of successfully treating the raw ores of that district. According to the annual report, their metallurgists made thorough tests of the Tippett-Crowe and Clancy processes in their experimental plants and made numerous experiments with a process that will be known as the Portland process. The company believes that this process will save 76 cents per ton for roasting and also $1 per ton in freight now paid for transporting the ore to Colorado Springs. Exhaustive tests have been made at Black Hawk, in Gilpin county, for the purpose of ascertaining the percentage of extraction in the local mills. The best extraction is said to be about 86% and the average extraction 60%. Nearly all the mills are equipped with amalgamating plates, Gilpin bumpers, and additional concentrators below, of recent patent. The saving in concentrate is nearly constant and the variation in extraction is found to be in the saving on the plates. Various cyanide processes are being tried for the purpose of bettering the extraction. In Clear Creek county, the Western Metals Co. has been organized to build a mill for the treatment of ores by the dry-chlorination process. The Griffith mines at Georgetown and the Stanley Mines Co. at Idaho Springs will be the first to install a plant with this process.

An additional levy of 10% has been made by the Cripple Creek Drainage Tunnel Co. This will amount to $40,000. About $150,000 of the original subscription remains unexpended. A total of 6021 ft. had been driven by February 17 and the completion is expected in 11 months. The Reliance dredge at Breckenridge, Summit county, has been steadily operated throughout the winter. This is the first time in this district that a dredge has been operated during the winter months, and the accomplishment of this feat will probably result in the operation of all the dredges next winter. The Colorado Gold Dredging Co. has two dredges in the field and will probably build two new ones of the latest make, as the first season's run has demonstrated that the operation is profitable. Both the Colorado Gold Dredging Co. and the French Gulch Gold Dredging Co. will resume work about March 15. The expense of operating the dredges has been lessened considerably by the entrance of two big power companies, the Central Colorado and the Summit County. It is confidently expected that the big dredges can be successfully operated on the bench deposits above the present placers. The Primos Mining Co. at Eldora, Boulder county, is shipping two cars of tungsten concentrate per day to their chemical works at Primos, Pa. Tungsten concentrate is now worth about $6 per unit for a 60% product, and an advance to $8 per unit is expected should the proposed new tariff bill go through. The Primos company is the leader in a movement toward a combination to promote the interests of the tungsten industry.

The shortness of the month, coupled with the severe weather and heavy snow-storms, cut down the ore production for February from all the camps in the State. The precipitation was the heaviest in eight years. In the San Juan district and in some of the more exposed camps of Hinsdale, Chaffee, Gunnison, Eagle, and Summit counties, mining had to be almost entirely abandoned. The enforced idleness at the mines, and the blocked transportation, combined to close the Durango smelter temporarily. The Camp Bird mill at Ouray has also been forced to shut down. At both of these plants the time is being improved in making needed repairs. There is considerable uneasiness in this district over the possibility of disastrous snow-slides as soon as the weather moderates. The production from Cripple Creek fell off 9012 tons, with a decrease in value of $217,071. Leadville also suffered severely, but the figures are not yet obtainable.

The Elkton Consolidated Mining & Milling Co. has paid its first bi-monthly dividend for 1909 to stockholders of record on February 13. The dividend was at the rate of one cent regular and one-half cent extra per share, amounting to $37,500. This makes the total dividends to date $2,279,466. The Camp Bird mine also paid its regular quarterly dividend of one shilling per share, making a total paid in dividends from this famous property since 1902 of $5,188,550.

The Denver Y. M. C. A. has instituted a course of lectures



The Central Part of Colorado.

on mining. The work is similar to that carried on by the Y. M. C. A. organization in Pennsylvania some years ago, when special courses of instruction were given in coal mining at the principal mining centres in that State. The lectures remaining to be delivered are: Ore Formation at Leadville, by J. C. Hersey, March 10; Chemical Treatment of Ores, by Philip Argall, March 17; Milling and Concentration, by F. E. Shephard, March 31; Mining Law Applied to Apex and Cross-lodes, G. L. Stevic, April 7; Prospecting, by R. C. Hills, April 21.

The State Land Board met in Denver on March 3 to sell Routt county coal lands. There had been charges of fraud against the old Land Board under the Buchtel administration in connection with the disposal of these same lands,

so the transfer of the land had never taken place. The charges of fraud were not upheld by the present board, and the land was sold in 160-acre tracts at prices ranging from $10 to $11.75 per acre. Out of the 5000 acres sold, 3820 acres went to H. H. Eddy and associates. Under the agreement the State reserves the right to collect royalties at 10c. per ton on all coal mined under this land. The land is also valuable for agricultural purposes, as water is available for irrigation.

MAZATLAN, MEXICO.

Transportation Facilities. — Rosario. — El Tajo Mine. — Milling Process.—Bullion Output.

Steamships from Manzanillo to Mazatlan, stop on the way at Las Peñas and San Blas, both ports on the coast of Tepic. Mazatlán, on the Sinaloa coast, has long been one of the most important western seaports of Mexico, and its prestige is now enhanced by connection with the Southern Pacific's west-coast railroad, just finished from Guaymas to Mazatlán. This road is being extended to Guadalajara. But the proposed harbor-improvements at Mazatlán have hardly commenced, the ocean steamships have to anchor in the bay a mile from the shore, and depend upon lighters to convey passengers and freight to and from the shallow landing. Las Peñas is a small town where sloping hills covered with cocoa-nut palms and banana trees come close to the water-front and overlook an open harbor; near by a river empties into the sea and here one gets a view of the tropical verdure of the valley. San Blas is a squalid little seaport, situated close to the mouth of the Santiago river, and from it extends a stage road to the town of Tepic, 40 miles easterly. Mazatlán is a city of 40,000 people, and has some large mercantile houses, but still clings to mule-power for its street cars. The Southern Pacific Co. has its main yards at the head of a small arm of the bay, but has built a spur to the principal wharf. From here wagon roads radiate to different places in the Sierra Madre—to Rosario, Copala, Panuca, Guadalupe de Los Reyes, and Concordia. To Rosario is 55 miles, and the trip is usually made at night, so one cannot see the cloud of fine dust in which he travels.



Tajo Mill, Rosario, Sinaloa.

Rosario is on the river of that name, in the State of Sinaloa, 12 miles from the coast, and only 100 ft. above sea-level. Here is situated the Tajo mine, first opened by Spanish operators 300 years ago. It belongs now to the Bradbury estate of Los Angeles, that family having owned it since 1870. Since February, 1906, the property has been managed by Geo. A. Tweedy. The mine-workings disclose a complicated system of veins in a fractured zone that strikes northeast through an andesite country. The orebodies are irregular, have a dip of 35° to the east, and in some places have a width of 150 ft. The holdings cover 4000 ft. on the strike of this zone. A big tonnage of ore is taken from open-cuts, the main pit from which it is hauled being 100 ft. below the surface. The two principal shafts are 1200 ft. apart, each reaching a depth of 500 ft., though one of these is being sunk below that level. It is a 2-compartment shaft, and is equipped with an electric hoist. There are 80 miles of workings above the 500-ft. level, which is therefore 400 ft. below sea-level. A considerable volume of water has to be handled, all of which is lifted from one shaft by an electric-driven Gould triplex pump. Much timbering is required, and for this purpose mahogany, ebony, and mesquite are employed. The ore consists of quartz carrying gold, and silver sulphide, but it contains no copper, and particularly no iron, nor other base metals. It is, therefore, capable of yielding a high extraction by simple processes. The old mill, which was in operation prior to the time when the present management took charge, was a pan-amalgamation plant. The new mill, designed and erected under Mr. Tweedy's direction, is situated on the bank of the river, 3800 ft. from the main shaft, and the ore is hauled to the mill by a steam locomotive. The mill has 60 stamps, which crush 3.8 to 4 tons of ore per stamp per 24 hr., through 0.75 mm. punched screens. The crushing is done in a weak cyanide solution. No amalgamating plates are used, nor is there any concentrating equipment or re-grinding machinery. The pulp passes from the batteries to settling tanks, four in number, each 35 ft. diam. by 5 ft. deep. The slime overflows from these tanks, the settled sand is distributed to 14 leaching vats, each 35 ft. diam. by 5 ft. deep; the slime goes to another set of settling tanks, each 35 ft. diam. by 10 ft. deep, thence to 10 tanks, each 24 by 10 ft., having mechanical stirrers and centrifugal pumps. Following this agitation in cyanide solution the slime is passed through an Oliver continuous filter, a second one of which was being installed. The capacity of each press is 70 tons. It is stated that the consumption of cyanide is 1.3 lb. per ton of ore, and that the milling costs amount to $1.50 per ton. The ore milled averages $8 per ton, the value-ratio of gold to silver being 2 to 1. The December bullion production was 41,601 oz. silver and 2020 oz. gold, the value of which was $63,068. It is claimed that the sand and slime tailing average one ounce silver per ton of ore, and but a trace of gold.

SALT LAKE, UTAH.

Copper Production.—Leaching Low-Grade Ore.—Ohio Mine and Mill. —Iron Blossom, Tintic.—Newhouse Mines and Smelter.

The estimated copper output from Utah mines in February is 7,380,000 lb. This is a slight decrease, due to February being a short month and to storms interfering with operations and shipments. At the Utah Copper the output was reduced considerably by the blocking of the railroad line between the mine and the milling plants, but in spite of this interruption the output was approximately half the entire copper tonnage of the State. The transportation question has been a most vexing one for the Utah Copper, and in case anything extraordinary occurs demurrage of plant is sure to follow. D. C. Jackling, manager for the Utah Copper Co., has stated that they have eighty acres of overburden, that carries from ¾ to 1% copper, which will give 20,000,000 tons of metal. They have conducted experiments, with the result that it has been proved that a profit can be made from the treatment of this product by leaching. The treatment of this deposit, however, is a question of the future.

Developments in the Ohio Copper properties at Bingham have been the most important in the history of the property. The vein has been opened on the tunnel level, which proves its continuance from the surface, or a distance of 1400 ft. on the dip of the vein. This orebody is 400 by 500 ft. and carries an average of 1.75% copper, and with the by-product of silver and gold, it is one of the big copper properties now being opened in the Bingham district. Colin McIntosh, manager for the company, says that they have ore sufficient to keep their milling plant, with a capacity of 2500 tons daily, in operation for more than 20 years. That is in addition to the tonnage of porphyry ores. The sulphide vein at the Mascotte tunnel level is stronger than it was near the surface, and indications point to continuance below the 1800-ft. level. The tunnel and shaft were completed Sunday, and after the shaft has been straightened up, the ore will be run from the various levels and sent by gravity to the mill at the mouth of the tunnel. The mill will be made ready by April 1, and from that time

forward the Ohio Copper will be one of the greatest producers in Utah.

Iron Blossom is claimed to be the greatest bonanza that Jesse Knight has ever opened up in the Tintic district. He says the vein is traceable more than 4000 ft., and the average high-grade ore recently found shows 40% lead, 113 oz. silver, and $13 gold per ton. This ore is sent direct to the Tintic smelting plant, which is also controlled by the Knight interests.

Samuel Newhouse has just returned from New York, where he has been promoting the Fink Smelters Company. He says they are now working out plans for the formation of a company that will take over the Newhouse mine in Beaver county, and consolidate it with the Fink smelting concern. This will mean the organization of a large company, and the Fink furnaces will be installed at the Newhouse mines at once. The Newhouse mill is closed while the low prices of copper prevail. The plant is being overhauled to admit of increased capacity. It will be capable of treating 25,000 tons of crude ore per month.

TORONTO, CANADA.

Nipissing. — Dividends by Cobalt Mines. — Canadian Institute Meeting.

At the Nipissing property the Fourth of July shaft is down 165 ft. During February ore valued at $75,000 was taken from this shaft while sinking. The shaft will be sunk to a depth of 200 ft. before driving is started. The five veins found in the shaft have united, making 8 in. of solid ore carrying 4000 oz. silver per ton. At the 100-ft. level in the Right of Way a good 6-in. vein has been struck. It is probably an off-shoot from the main vein. The company has declared a quarterly dividend of 6%, with a 9% bonus. At the La Rose driving is being done at the 180-ft. level in both directions from the raise, between the 110 and 200-ft. levels, and rich ore is being extracted. A somewhat discouraging report was presented at the general meeting of the Cobalt Lake Co. held at Ottawa Feb. 27. Working expenses for the year were $142,554 and receipts $83,547. E. L. Fraleck, the engineer, hopes shortly to cut the McKinley-Darragh vein, and is also endeavoring to strike ore at the north end of the Right of Way. But so far the actual results from extensive development have been disappointing. The Temiskaming & Hudson Bay Co. recently declared a dividend of $3 per share, or 300%, the shares being $1 each. This makes total dividends since 1905 of 12,400%. At the Beaver, where for some time endeavors have been made to find the big Temiskaming vein, ore was struck in driving at the 200-ft. level 244 ft. from the main shaft. The vein is smaltite carrying silver. Crown Reserve is looking up in the market, as some rich ore is being worked at a depth of over 150 ft., and is yielding assays of 10,000 oz. per ton. In the Silver Leaf, in endeavoring to pick up a vein which had yielded rich ore, but which some time ago pinched out, a 3-in. vein with silver was cut, the wall-rock also yielding silver. The Otisse mine in the Montreal River district is yielding well. A narrow vein, struck at 43 ft., has developed at the 55-ft. level to a considerable width, and carries silver to the extent of about 3000 oz. per ton, with the wall-rock carrying much silver also. The Elk Lake Discovery in the same district has a rich vein, 1 in. wide, on which a shaft is down 40 ft. On the Big Six a shaft is down 75 ft. on a vein showing silver. A plant has been ordered.

The eleventh annual convention of the Canadian Mining Institute was held at the Windsor Hotel, Montreal, commencing on March 3, with an attendance of several hundred. Willet G. Miller, Provincial Geologist of Ontario, president of the Institute, gave the opening address, reviewing the history of the organization. It was founded in 1898, and its growth and influence had been proportionate to the development of mining industry in Canada, the annual output of the Dominion having increased in the interval from $38,000,000 to $87,000,000. The membership of the Institute had meanwhile increased from 65 to 830. He pointed out that the development of Canada's mineral wealth was just beginning. The tendency in the past had been to regard the maritime provinces and British Columbia as the great mineral areas and the interior provinces as purely agricultural. This was a fallacy, as the formation of pre-Cambrian origin which constituted 2,000,000 of the 3,700,000 square miles of Canadian territory contained great mineral resources. It was in this formation that the Sudbury and Cobalt ores occurred.

The election of officers resulted in the following selections: President, Willet G. Miller, Toronto; vice-presidents, A. E. Barlow, Montreal, and J. Obalski, Quebec; secretary, H. Mortimer Lamb; councillors, W. R. Brock, Ottawa; J. Stevenson Brown, Montreal; Thomas Cantlay, New Glasgow, N. S.; C. J. Call, Stellarton, N. S.; John Donnelly, Kingston, Ont.; E. L. Fraleck, Cobalt; H. E. T. Haultain, Toronto; L. Milton Hersey and J. P. Bonsall, Montreal.

A. C. Lane, State Geologist of Michigan, submitted an illustrated paper on 'The Mine Waters of Michigan', presenting tabulated results of the chemical analyses of waters of the iron mines in explanation of theories as to the mode of deposition. Other papers presented were 'Notes of Mine Examination and Investments Considered from a Commercial Standpoint', by J. C. Haas, of Spokane, Washington; 'Mine Accidents', by E. T. Corkill, Ontario Inspector of Mines; and 'Nitro-Starch Dynamite', by A. Moscovici, Montreal.

MEXICO.

Torreon Smelter. — Smelter Competition. — Monterrey Steel Plant. Zinc Tariff.—Minas Prietas.

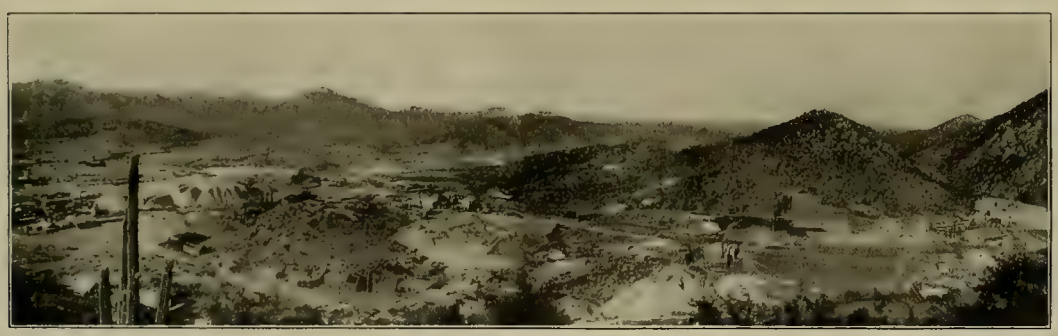
According to Ernesto Madero, president of the Torreón Metallurgical Co., the deal that was pending for the sale of that company's interests, including the smelting plant at Torreón and the mines and leases at Cabrillas, Monterrey, Santa Barbara, and Sierra Mojada, to the International Smelting & Refining Co., has been declared off. As the Torreón plant is the only really available one for the International to acquire that could greatly annoy the American Smelting & Refining Co., it would look as though heavy competition against the latter was not yet probable in Mexico. It was rumored that the International was negotiating for Smelter No. 2 of the Monterrey M., S. & R. Co., and also that threats were made that unless Torreón came to terms the International would erect a competing plant at Gomez Palacio, a couple of miles farther north. To anyone familiar with the smelting situation in Mexico, neither of these rumors is worthy of much consideration. The Monterrey company, commonly spoken of as Smelter No. 2, is an independent Mexican concern, and while it has some good mines and leases, and does a good business at its refinery, and usually pays satisfactory dividends, nevertheless the smelting plant is rather a tumble-down affair, consisting of 8 small furnaces, using hand slag-pots, and it is poorly situated. It would not greatly attract a prospective buyer, and to be a worthy competitor in the smelting business in Mexico it would have to be entirely re-built. The Torreón company owns a number of mines and leases, and is thoroughly established after 7 years of operation. Just west of Torreón, in Durango, is the Velardeña plant of the American Smelters' Securities Co., operated by the A. S. & R. Co.; south of the city, near enough to be a strong competitor, is the Aguascalientes plant of the A. S. & R. Co.; east of Torreón, at Saltillo, is the new plant of the Mazapil Copper Co., which does some custom smelting, and at Monterrey are Smelter No. 2 and Smelter No. 3, of the A. S. & R. Co.; while north of Torreón, at Santa Rosalía, is the Encinillas plant, which has finally resumed operations, and by virtue of its recent contract for the San Pedro ores of Naica, and others of Parral, Almoloya, and Sierra Mojada, must be given consideration. Finally at Chihuahua is the new plant of the A. S. & R. Co., now operating three furnaces, to which two more are likely to be added. With a well established plant now operating at Torreón, and others surrounding it on all sides, it does not seem probable that another will be built. Ernesto Madero also states that the A. S. & R. Co. has made no attempt to get the Torreón

plant since the negotiations of three or four years ago.

The Monterrey steel plant is busy getting out its order of 25,000 tons of 85-lb. rails for the Mexican National railroad, and this is a great help to the city commercially, but there is some doubt as to whether the steel company will be able to win a profit on this the largest order it has ever had. The plant itself is apparently satisfactory, but it is stated that the waste and the losses are large. Largely for the protection of this plant was the duty adjusted on iron and steel products, and unless the company can make good there will be no reason for retention of the present tariff.

The decision of the United States courts in declaring zinc carbonates entitled to free entry has added to the good feeling at Monterrey. The petitions of the Missouri and Colorado Legislatures for a tariff on zinc as well as lead ores, however, causes anxiety.

The Creston-Colorada Mining Co., operating in the Minas Prietas district, State of Sonora, is under the management of M. F. Perry. There is an 1100-ft. shaft on the Creston at Minas Prietas, and an 800-ft. shaft on the Colorada mine at La Colorada. These villages are one mile apart, and the mills are at La Colorada. An Otto aerial tramway, 4000 ft. long, carries the ore from the Creston mine, and a shorter tramway from the Colorada, both delivering to the 30-stamp mill, which crushes 7500 to 8000 tons of ore per month. This mill, in addition to the 30 stamps, has 8 Huntington mills, one Krupp tube-mill, with 14 leaching tanks and hydraulic sizers. The stamp batteries reduce the ore to only ½-in. size; the Huntingtons follow, and crush to 16 mesh. The pulp from the latter goes to classifiers, the coarse sand passing to the sand-vats, and the fine to the tube-mill. The product of the tube-mills is classified by cone-sizers, the overflow passing through a settling device, thence to the slime-plant; the underflow is re-ground in the tube-mill, and then goes to the slime-plant, in which all pulp treated is 200 mesh or finer. The sand is 80 mesh size. The sand-treatment consists of three washes, each of cyanide solution containing 6 lb. KCy per ton of solution, followed by three washes of a 4½-lb. solution, then by four washes of barren solution, and finally a water-wash. The first six washes consist of 33 tons of solution each, the charge of sand being 120 to 130 tons. The slime-plant consists of 6 main-tanks, 2 collecting-vats, and 4 agitating tanks. The slime is subjected to agitation for 12 hr. before it passes to the main-tanks. The strength of the solution used is 2½ lb. KCy per ton of solution. After being settled in the main-tanks the solution passes through Butters filters to the precipitating boxes. The ore thus treated contains 7 to 8 oz. silver, and $6 to $7 gold per ton, making an average of about $11 per ton. It is stated that the extraction amounts to 75% of the silver, and 85% of the gold. The silver is mostly present as argentite, and the gold is associated with it. The company has leased and is operating the old Grand Central mill, which now belongs to the Butters Co. It is handling 180 tons of tailing per day that accumulated at the old Colorada mill when the latter was operated as a Boss continuous pan-amalgamation plant. This tailing is said to contain about $8 per ton in silver and gold. It is treated in the leased Butters mill by an all-slime process, consisting of tube-milling, classifying, re-pulverizing, and cyanidation in slime-tanks. The electric precipitation employed in the slime-plant is regarded as satisfactory. Geo. A. Schroter, of New York and Denver, is consulting engineer for this company, and C. E. Cleaveland is superintendent of the cyanide plants. Among the other mill-men are Ed. Powell, P. H. Crawford, and F. E. Steele. Gus. Schoglund is mine superintendent, and R. R. Wheeler master mechanic. The company owns the narrow-gauge railroad that operates between Torres and Minas Prietas, a distance of 15 miles.



Minas Prietas, Sonora, Mexico.

JOHANNESBURG, TRANSVAAL.

Metallurgical Progress.—An All-Cyanide Scheme.—Mineral Production. — Electric Power Station.—Accident Rate. — Flood.

A month or two ago, I was able to publish a few notes in these columns with reference to the improvements in metallurgical practice being effected by the Consolidated Gold Fields group. The experiments at the Simmer & Jack and at the Simmer Deep batteries principally affect the operation of pulp-classification. The Eckstein group has also been actively working on experimental lines, and the scheme proposed for introduction on a small working scale at the Bantjes Consolidated (a newly resuscitated mine in the Florida district of the Rand) contains numerous points of novelty and interest. The idea has been worked out by W. K. Betty, who appears to have obtained the keen support of W. W. Mein, general manager of the Central Administration mines, to which group the Bantjes belongs.

The scheme in its initial stage embodies the idea, not yet attempted upon the Rand, though put into practice elsewhere, as in the Waihi mill, New Zealand, of establishing an amalgamation-house apart from the battery. The advantages of this system are several, and have often been discussed in technical writings. Not only is time saved by the continuity of full crushing when plates are being dressed, but the dangers of theft are materially reduced. The change fits admirably into the recent plan of employing only white men in places where gold—in amalgam or slime—is actually handled. According to the present proposal, the extractor-boxes and the plates will be under the same roof, further minimizing the risks of gold-stealing. To what extent the mills are robbed by dishonest employees, it is impossible to suggest. Judging by actual convictions, the amount taken is small, but unfortunately the police records have in the past provided an inadequate guide for the estimation of the Rand's 'undeclared output'. It is certain that companies can afford to bear considerable expense for the purpose of checking the illicit buying of gold.

The Bantjes scheme, in its first stage of development, goes further than this centralization of gold-recovery. In order to obtain higher stamp-duties, with tube-mills as auxiliaries, it has been necessary on the Rand to adopt coarser and coarser screening. The particles thus liberated from the boxes are consequently of such a size as to have an undesirable scouring effect upon the tube-mills, and the

shaking amalgamating tables. A big proportion of the stamp-battery product will therefore be cyanided, as sand or slime, without previous amalgamation, while the coarse sand will be separated by means of the usual spitskasten for re-grinding in the tube-mills. A certain amount of coarse free gold may be caught below the stamps in the launder which carries the pulp to the pumps used for elevating to the classifiers, in the same manner as in a riffleless sluice-box. In any case this could not be lost. The plant being erected at the Bantjes is of a comparatively small capacity (10,000 tons per month, on an estimated stamp-duty of 10 tons per day) and the advantage of economy of labor in this case will be of small account. In a large plant, however, the scheme would result in a substantial saving in costs of supervision.

That the above ideas will be put into practice, as soon as the Bantjes reaches the producing stage, is assured; but it is possible that the occasion will be seized for working on still more original lines. It is tentatively proposed to attempt gold-recovery without employing the amalgamation process at all. The plant would then comprise 35 stamps weighing as much as 1650 lb., a tube-mill, and a sand and slime plant, with essential classifiers. The Adair-Usher process of slime-treatment would be employed to facilitate operations. Such an experiment would involve no abnormal risk, for, if unsuccessful, shaking plates could be easily introduced below the tube-mill to bring the sequence of units into the range of proved practice. If the Bantjes company undertakes the experiment at its own cost, however, it will be performing pioneer work of a promising character, meriting the thanks of all Rand metallurgical engineers. Although technical gratitude is long-lived on the Rand and well appreciated by those who win it, there seems to be no objection to the proposal that such experimental work should be undertaken with the financial support of the lately-constituted Mines Trials Committee under conditions which would give the industry as a whole the greatest possible benefit from the lessons derived.

The Government Mines Department has published its monthly statistics for December, so that the records for 1908 are now complete. In spite of a heavy fall in the value of diamonds produced, owing to the market weakness, the aggregate output of all minerals for the Transvaal shows a satisfactory increase as compared with the figures for 1907. The declarations for the two years stand as follows:

	1908.	1907.
Gold	£29,980,526	£27,400,992
Diamonds	1,549,815	2,268,075
Coal	794,949	773,649
Base metals	246,766	192,296
Silver in gold bullion	85,032	91,893
	£32,657,088	£30,726,905

According to these statistics, the increase in gold yield is £2,579,534, and the decrease in the value of diamonds, £718,260. Forecasting the future development of the various mineral industries, the most confident prediction which may be attempted is that the output of gold and its associated silver, and of base metals—notably tin—will increase steadily for some years to come. Apart from the favorable indications attending prospecting in several areas, which give promise of increased tin production in the near future, strength is given to the assumption of a greater output of this metal by the more advanced operators of the Weynek and the Rooiberg companies in the Waterberg district. The former venture commenced milling on a small scale recently, and the latter promises to become a producer in March next. The expansion of the diamond industry is dependent solely upon the market. Shortly, new plant will be erected at the Premier mine, giving the company a producing capacity of about twice its present standard.

The future of the coal mines has been rendered less promising by the recent announcement of the Victoria Falls Power Co. to the effect that, through an important amalgamation of interests, it has secured contracts for supplying all the mines under the Eckstein control with electric power. In a couple of years the steam-plants on these properties will be maintained merely as auxiliaries in case of break-downs, and will eventually be discarded. The contracts obtained render it safe to lay down a new power-station with an initial capacity of 90,000 kw. This will supply companies treating, at the time of the station's completion, seven or eight million tons of ore per annum, and it is estimated that the scheme will save the consumers in power-costs 8d. per ton of ore milled. A subordinate part of the scheme involves the erection also of three central compressed-air generating stations on the Rand.

The electrification of the Rand began three or four years ago upon certain mines in the Germiston district. With the completion of the present scheme, a great advance will have been made toward the ideal steadfastly advocated by electrical men upon the field for many years, namely, the utilization of electricity to a maximum degree in all the major branches of power-consumption. It is to be hoped that the Victoria Falls Power Co. will now change its name so that the mistaken idea may not get abroad that the former scheme of serving the Rand mines with electricity generated at the Zambesi river has been carried into effect, though there is still hope that the vast Rhodesian fall will be harnessed for service in Charterland. Existing power-stations are situated where coal can be cheaply obtained to operate the prime-movers and the new station will be within thirty miles of the Central Rand.

The Rand's accident rate for the past year shows a gratifying decrease as compared with 1907. A broad classification may be arranged comparatively as follows:

	1908. (Total employees, 180,000.)		1907. (Total employees, 160,000.)	
Accidents due to:	Killed.	Injured.	Killed.	Injured.
Fall of ground	204	245	197	221
Explosives	209	177	280	263
Miscellaneous	299	644	333	576
	712	1066	810	1060

Unfortunately the current year has commenced unpropitiously from the accident point of view, and the record to date has been rendered exceptionally unfavorable by the occurrence of two or three serious disasters. On January 22, during a sequence of abnormally heavy rains, the dam of the May Consolidated burst and, carrying with it the Glencairn's old slime-dam, poured as a great wave down into an old prospecting shaft on the northern outcrop of the Witwatersrand gold mine (commonly known as Knight's). The mine speedily filled with water, and almost every man at work below was believed to be drowned. Until all hope has to be abandoned by the actual recovery of the men's corpses, however, every effort will be made to de-water the mine and explore every possible place where refuge may have been taken. Owing to the rapidity of the occurrence, little hope of saving life was entertained. On January 29, the pluck and determination of the management, however, was rewarded by a wonderful discovery. In a small backstope, from which the water had been excluded by the pressure of the confined air, 25 natives were found alive after seven days foodless imprisonment. Their physical condition must be described as little short of miraculous and has been a surprise even to those with the most intimate knowledge of the Kaffir's powers of physical endurance. Three of the 'boys' even anticipated the labors of the rescue party by swimming for some distance along the drive—though one of these sank with exhaustion. The others, after receiving nourishment, speedily regained strength and vitality, and begged to be allowed to return to their fellows in the compound before such a request could possibly be granted. One of the Kaffirs, who had been entombed in an isolated place, made his way to the mine captain's office upon reaching the surface to enquire anxiously if his 'ticket' would be duly signed for the seven double shifts he had spent below. Up to the time of writing (Jan. 31), 25 men and 26 bodies have been recovered, out of the 160 working below at the time of the disaster.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Mexico contains 20,000 Americans, who are engaged in enterprises involving a capital expenditure of $900,000,000.

Epigenetic deposits of ore are those which have resulted from replacement or alteration of rocks and minerals. Similarly the term is applied to any mineral which has been derived from the alteration of another.

Platinum has been found in quartz veins in gneissoid syenite, associated with gold, near Santa Rosa, Antioquia, Colombia. This occurrence has been known for nearly a century, and was described by Boussingault.

Copper at Corocoro, Bolivia, occurs in Permian sandstones and conglomerates, the metal being in metallic form. The distribution of the copper is not uniform through the deposit, which offers an obstacle to economical mining. The ore is accompanied by gypsum, and in the lower parts of the bed native silver is found.

Latest additions to the table of atomic weights by the International Committee are two in number. Urbain, a French chemist, has proved that ytterbium is a mixture of two elements which he has named neoytterbium and lutecium, the former having an atomic weight of 172.0, and the latter 174.0. There are now 81 elements recognized by the Committee.

Steam turbines are considered to offer the following advantages over reciprocating engines: they develop high efficiency at low loads; their rate of rotation continues uniform, decreasing the liability of 'hunting', and lessening the strains on the foundations; smaller size, weight, and space for equal power; and lessened cost for attendance, maintenance, and repairs.

The point system was adopted in 1883 by the Typefounders Association of the United States, to introduce a unit of measure whereby types from different foundries might be made interchangeable. With the introduction of this system the old names of typebodies were abandoned; for instance, brevier became 8-point, and long primer, 10-point. These columns are printed in 10-point, and 72 points are equivalent to an inch.

Burnt clay roads are made by laying brush wood to a suitable depth on the surface, and then throwing the earth from each side upon the bed of fuel. The clay after being burnt loses its power of becoming plastic, and will sustain vehicular traffic without cutting into deep ruts, as happens in clay lands where such treatment has not been given. The clay will often vitrify to some extent, giving a gravelly texture to the surface. When vitrification occurs the artificial road-metal produced possesses superior efficiency. Such material has been used with considerable success as railroad ballast, although some disappointments have attended its use for this purpose.

Gold-bearing gravels cannot be tested by shafts when water is found rising to any considerable height above bedrock, without large expense in coffer-dam construction. Even then, the tendency of sand to run in from the sides is great. This will carry gold into the shaft and falsify the sample to an extent which cannot be estimated. Under such situations the drill-samples must be relied on, and safety reached through multiplicity of drill-holes.

Calamine violet is the name given to a variety of the crow's foot violet which changes its natural brilliant blue color to an equally brilliant yellow when zinc is present in the soil. It is one of the few well established instances of alterations in the color of flowers due to metallic salts. The subject might properly engage the attention of some of the Experiment Stations in the West. Other like relationships might thus be proved to have significance for the prospector.

Determination of the degree of concentration effected in the milling of a uniform ore may be rapidly done with a fair approximation to accuracy by the use of the specific-gravity bottle. Knowing the weight of the bottle filled with water to a graduation-mark on the neck, a sample of the dried concentrate weighing 5 to 10 gm. is introduced into the bottle, and distilled water is then added until the meniscus rests on the graduation line. The bottle with its contents is then weighed. The specific gravity of the concentrate is then calculated from the formula:

$$\text{sp. gr.} = \frac{W}{(W + A) - K}$$

where W = weight of concentrate taken.
A = weight of bottle filled with distilled water.
K = weight of bottle and concentrate, with water filled to graduation mark.

Adiabatic curves are the graphic representation of the relation between the pressure and volume of a gas during its change of volume through expansion or contraction without absorbing or evolving heat. When adiabatic lines cross isothermal lines they are always inclined to the horizontal at a greater angle than the isothermal lines, because as the gas expands the pressure diminishes more rapidly than for an isothermal line, since the temperature is reduced by the work done in expanding under pressure. When air is compressed without cooling it is said to be adiabatically compressed, and under such conditions the pressure rises in more rapid ratio than the volume of the air diminishes. Therefore the power required is greater than when, by means of cooling, the air is compressed so as to approximate a uniform temperature throughout the operation, that is, isothermally. Neither form of compression is attainable, the net result being a combination of the two. The relation between the curves of actual compression and the ideal adiabatic and isothermal curves, is an indication of the mechanical efficiency of the compression.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mr. Ralston and the Institute.

The Editor:

Sir—Two surprises awaited me on Saturday last: one that I had been nominated for the office of Vice-President of the American Institute of Mining Engineers, and the other that the MINING AND SCIENTIFIC PRESS objected to me personally on grounds stated. I feel constrained to answer your editorial, much as I dislike newspaper controversy on personal matters. Why you should protest against my nomination seems to me rather strange, if only in view of the fact that I have been a full member of the Institute for the past nineteen years and have already served one term in 1900-1901 as Vice-President. Eligibility for membership in the Institute naturally means also eligibility for holding any of its offices. It is not confined to mining engineers only, but to "all professional mining engineers, geologists, metallurgists, or chemists, and all persons practically engaged in mining." I may say that up to four years ago, when for two years I accepted the presidency of the Fulton Iron Works, I had followed the business of mining for a period of nineteen years. During that time I served my apprenticeship as ditch-tender, surface and underground miner, shift-boss, foreman, superintendent and manager of both gravel and quartz mines, constructor and operator of mills, etc., and am still interested directly in legitimate mining. I am at present, among other things, a director and treasurer of one of the most productive gold mines of the world, and sharing its active management. It is true that I am not a graduate of any school of mines, a fact which I regret more than anyone else can, but I was obliged to go to work and earn my own living at the age of sixteen, a few years after the death of my father, first starting as a helper in the assay-office of the Selby Smelting & Lead Co. I subsequently went to work as a miner in Placer county, and after that took a special course in mining in the University of California for six months, which was all I could afford at the time. I recite these facts merely to show that I have been "practically engaged in mining," which is one of the requirements for membership in the Institute.

I fancy I may have been selected by the nominating committee as a candidate for Vice-President merely for the reason that they wished someone from the far Western mining States. I was not an applicant for the honor in any manner, nor did I know of their action until I read of it in your paper.

You say I am "a politician and a broker," which is true, and seem to consider that this should effectually dispose of any claim I might have for the office in question. I see nothing to be ashamed of, for in my opinion if more men would talk less about reform and serve their States in the Legislature properly, we would have less vicious legislation. As a politician, I had the honor of being chosen Speaker *pro tem* of the Assembly; of being Chairman of the Committee of Mines and Mining; and the ranking member of the Ways and Means Committee. The following session, as a member of the State Senate, I was appointed Chairman of the Committee on Mines, and during my term was a member of the committee of five who commenced the real reform movement against graft by recommending the expulsion of four Senators for receiving bribes, which recommendation was concurred in. I confess I feel somewhat proud of my record as a politician and intend to continue my interest in the public affairs of my City, State, and Nation. In my way of thinking, the man who takes no interest in politics is not a good citizen.

For the fact that I am a member of the San Francisco Stock & Exchange Board I have no apology to make, nor is it necessary. A market value for the shares of the mining corporations cannot well be established except by listing them on stock boards. Of course all stocks so listed do not necessarily have intrinsic value, and some changes in methods would improve the business. No one has tried more earnestly than I have to bring about such changes. The business of a mining stock-broker is as legitimate and honest as any. If it be wrong to buy and sell mining shares on commission, it is also wrong to buy and sell them for personal profit. Yet I have among my clients in the purchase and sale of mining shares, some of the most distinguished mining engineers on this coast and elsewhere. It may then be also wrong to advertise the prices brought by the purchases and sales, yet your paper prints these quotations weekly, obtained I may incidentally remark, from my own office. If there be anything morally wrong in any part of this business of mining share dealing, it is wrong in all, but this I deny. Of course there may be dishonest brokers as well as dishonest mining engineers, but neither business should be condemned for this reason.

You have always seemed to enjoy 'taking a fling' at the California Miners' Association. Let me say that in the past this Association has done much for the mineral industry of this State and in the near future will doubtless be called upon to prevent vicious legislation. While little or nothing has been accomplished in the past two years, yet the strength of the Association may be shown at very short notice when occasion arises. The Association merits the assistance of a paper like yours, rather than adverse comment.

I wish to be permitted to say that you are utterly and unqualifiedly mistaken in your conclusion that I "depreciate and repudiate mining engineers as a guide to the development and operation of mines." I never made any such statement, nor am I a believer in it. You have doubtless heard me say "that the tendency of the average School of Mines graduate is a desire to start in as a boss and is unwilling to start in at the bottom and gain some practical experience; that he is generally of an age when it is objec-

tionable to him to perform the labor of a miner." I have said this and repeat it.

I was born in San Francisco and raised in California, and while my education has been of the mountains and my advancement slow, yet my reputation and standing in the mining world, such as it may be, I think permits me to call myself a mining engineer fully as much as others who are not at the present moment following that line of work.

W. C. Ralston.

San Francisco, February 1.

[The following correspondence is published in order to explain the delay in the appearance of Mr. Ralston's rejoinder.—Editor.]

Mr. W. C. Ralston,
Care of Mr. J. D. Irving,
Yale Univ., New Haven, Conn.

My dear Ralston:

Your letter in reply to my editorial arrived after we had gone to press with the part of the paper in which it would naturally appear, that is, the Discussion department. Therefore, I held it over for this week. In the meanwhile, Mr. Kinsman came to see me, and I received a letter from Mr. Benjamin. This morning, Mr. Creswell was here, and I had a long chat with him. He authorized me not to publish your letter thinking that it was to your interest that it should not be published, for I told him that if I did publish it, I would have to give chapter and verse for my statement that you repudiated the mining engineer as a factor in mine development. My authority is Mr. De Kalb and another friend to whom you spoke rather carelessly, saying that you had no "damn use for a mining engineer's report," and that when you had a mine to sell, you would not have a mining engineer examine it, etc.

As the controversy is not with you, but with the powers of the Institute for the irregularity of their method of nominating officers, I was glad to accept the suggestion of Mr. Creswell that your letter be not published. The letter is an excellent one, and makes a good retort, and I would have been very glad to have published it except for the last paragraph but one, in which you deny the accuracy of a statement of mine, for which I have ample evidence.

Trusting that you will absolve me from any personal motive in this matter, I am,

Yours faithfully,

T. A. Rickard.

San Francisco, February 8.

T. A. Rickard, Esq.,
667 Howard St., City.

My dear Mr. Rickard:

When in the City of New York I received telegrams from some of my friends in this city suggesting that my letter to you of the first day of February, 1909, should not be published by you. Having other matters at the time to think of, I requested Mr. Creswell to see you and use his own judgment in the premises. Since my return I have been unable to take up this question before today.

I am writing now for the purpose of informing you that after inquiring into the whole subject matter, I see no reason why my letter to you should not be published in your paper as a reply to your editorial. I would be pleased to have you publish it as written if you will kindly do so.

Yours truly,

W. C. Ralston.

San Francisco, March 4.

Geological Hierophants.

The Editor:

Sir—I have laughed with you at the verbal singularities of that scrap of petrographic literature over which you made merry in a recent issue, but one may laugh and not agree. There are many, however, who will not only laugh at the playful humor of your editorial, but will seriously accept your pleasantries as a denunciation of the efforts of technologists to describe a rock in accurate terms without having to write a chapter to avoid mistake. The common names of rocks are misleading; even when qualified as to predominant accessory minerals, they fail to convey definite ideas of composition and structural peculiarities. It is by no means certain, for example, what character of rock is implied by the term anorthosite. The tendency would be to think of the type-rock, composed almost exclusively of labradorite, although close conformity to such an ideal is rare through extensive areas. The rock is almost certain to approximate the gabbros, and a mineralogical description would be necessary to convey accurate information of its composition. The thing to aim at in description, whether it be scientific or popular, is to use terms adequate for the purpose. If one refer to a dike cutting a certain formation, and the point at issue concerns structural relationships, it would reveal a pedantic streak in the brain to call it a dike of augite-basalt-porphyry, when basalt would be quite enough for the purpose; but if it be intended to call attention to related physical phenomena the fact that it was a porphyritic augite-basalt or melaphyre would be important; it would indicate more narrowly the composition of the original magma, and some of the circumstances attending its consolidation, which would at once call to the mind of a man competent to appreciate the practical significance of the record probabilities of more extended relationships. If the important point be the approximate chemical composition of the rock, it may be stated in the form of a chemical analysis, which might be misleading because too exact to cover the unavoidable variations within a magma of any size; it may be stated cumbrously in so-called plain language which would promptly involve the description in obscurity through mere verbosity; or it may be systematically described by terms of precise meaning according to the system which you have made the subject of jocular remarks. In Professional Paper 62 where a syenitic rock is described by the system of mineralogico-chemical analysis the characteristics accurately indicated are important. In other parts of the report other terms sufficient for the purpose are employed.

The almost hopeless confusion which has existed

in petrographic classification, resulting from the complexity of the subject, was the moving cause for the effort at reform on rational lines. It is a cardinal principle that the old familiar words of common speech are unsuited for exact technical definition because they are inevitably taken with a tincture of the old meaning. Thus the committee on quantitative rock-classification wisely introduced new and unfamiliar terms with definite significance, but so suggestive of names in common use as to indicate well understood relationships. It certainly marks a long step in advance over any system previously employed, and tends to deliver petrographic descriptions from chaotic confusion.

The pity of scoffing at the employment of accurate nomenclature where such decisiveness be necessary is that it serves the purpose of those whose joy is to cast aspersions upon the economic geologist, in order that nefarious schemes may be promoted under cover of hazards taken in the dark. Wild-cat promoters do not wish the revelations of science; they care not for truth; they care only for the money of the gudgeons; and the jesting of a technical editor, making ridiculous the efforts of economic geologists to say what they mean in unequivocal terms, plays directly into the hands of those whose practices you have ever stoutly condemned. Your 'Geological Hierophants' must have been written in a moment of inadvertence.

NORM.

San Francisco, March 2.

[This is a reasonable protest, and if Professional Paper No. 62 had been intended to form part of the proceedings of a scientific society, it would be conclusive. But the publications of the Geological Survey are not addressed to scientific men only, or even largely; they are made under an appropriation from Congress with the idea of proving of general service to those engaged in the development of the mineral resources of the continent. As thus regarded, one cannot forbear from seeing the humor of such a hierophantic performance as that quoted from No. 62. Imagine a mine superintendent at Wardner lighting on the offending paragraph—it is fit subject for a cartoon! At the same time we appreciate the value of terms of precision and admire writers who try to use them in a scientific manner. If read to an audience of mineralogists that description of the syenitic rock in the Coeur d'Alene would be admirable; as a means of imparting information to those engaged in mining operations, it is absurd.—EDITOR.]

Fink Process.

The Editor:

Sir—In a recent issue you make a statement concerning the Fink process, as follows: "At 10 o'clock Saturday night January 16, the first pouring of blister copper ever made in a single process furnace was accomplished at the Edward Fink plant at Garfield, Utah," etc. While not wishing in any way to detract from the value of the results attained by Messrs. Fink and Newhouse with their new furnace, I still think the statement made is an error, as J. E. Knudsen at Sulitjelma in Norway has for several years been operating a converter on ore direct, producing at will either high-grade copper matte or blister copper. This plant has been inspected by many of our best copper metallurgists and their reports as to the efficiency and capabilities of the method are on record. In Mr. Knudsen's furnace, which is a simple style of 'converter', the ore is charged onto a small body of fuel, either slack coal or wood being used; the blast is introduced through suitably situated tuyeres, and thereafter until the pouring of matte or copper the combustion of the sulphur and iron furnishes all the heat of the smelting process. Mr. Knudsen does not pretend to make a clean slag at this one operation; he pours the slag or transfers it to a settling-furnace where it has a chance to clear itself of mechanically contained shots of metal or matte. The costs of the Knudsen method are to be had on inquiry, the Metallurgical Co. of America being the representative for this country. I do not think that Mr. Knudsen claims to treat fine ore, concentrate, or slime, with success; a large percentage of such material would naturally interfere with the reactions in the vertical converter, or would be lost, temporarily at least, in the gases.

The Knudsen plant is not running as an experimental or test plant but as a regular smelting operation every day; the ores are pyritic, carrying from 3.55 to 6.31% copper, 32 to 34.5 iron, 24.4 to 29.1 silica. The matte resulting from these charges carries from 45 to 72% copper and is as a rule poured and taken to regularly operated converters. This is done because it is found cheaper to carry out the process in two vessels and in two stages, rather than to confuse the reactions in one vessel by attempting to perform two operations either together or consecutively. The slags from this operation carry, after settling, about 1% copper and 35.5% silica.

Ralph Baggaley of Pittsburg has patented a horizontal smelting vessel, or converter, lined with basic brick, in which he proposes to carry on both the smelting and converting reactions, the latter at least in part; this furnace, however, was not built and tested in Butte at the time Mr. Baggaley's other inventions were tried out, therefore we cannot give him the precedence in this matter. Verily it sometimes seems that "there is nothing new under the sun!"

JAMES W. NEILL.

Pasadena, March 1.

Progress in Cyanidation.

The Editor:

Sir—In your issue of January 30, I notice the appreciative reference of Capt. Francisco Narváez, of Pachuca, to my article upon 'Progress in Cyanidation', and note that Capt. Narváez now does all his crushing by Chilean mills. This is interesting news, and I hope he will give us the benefit of his most recent results, including wear and tear, working costs, horse-power, consumption, fineness of original feed and of crushed product. It will probably interest him to know that his work is being keenly followed elsewhere, and that in Rhodesia particularly

Chilean mills are being largely employed. My reference to soft ore is evidently due to a misunderstanding of his precise expression when he was so good as to personally give me details of his work. The feed to the Chilean mills was obviously finer than that sent to the ball mills, as Capt. Narvaéz now confirms, and I understood him to say it was also softer. The correction apparently makes my statement as to the work of his mills all the stronger, for it now appears that he is able to crush 15 metric tons per diem for a consumption of 10 hp. from 1½ in. cube to 80% through 200 mesh at a cost, including 10% depreciation, of 0.7 peso (17¼d.) per ton on the general average rock produced by his mine. Possibly these results have already been improved on by him.

ALFRED JAMES.

London, February 17.

Titular Prefixes.

The Editor:

Sir—I note your remarks on the misuse of titular prefixes, in the issue of the 20th inst., in all of which I fully concur. In the note immediately preceding, you speak of Senator Henry M. Teller. Would it not have shown greater consistency if you had referred to that gentleman as Mr. Henry M. Teller, United States Senator for Colorado?

A. JEWEL.

Berkeley, February 22.

[Yes; "consistency is the jewel of small minds."—EDITOR.]

Researches in Diamond Making.

The Editor:

Sir—Referring to Mr. D. Mosher's letter in your issue of the 20th inst., concerning my article on 'Researches in Diamond Making', appearing in your issue of December 5, 1908, I think he has not quite followed the drift of the article. I did not understand, nor was it my intention to convey to the reader that Mr. Threlfall used the excessive temperatures, in his experiments, with the idea that diamonds would crystallize at those temperatures; but rather, that the high temperatures were used to insure the liquefaction of the carbon, in the hope that as it cooled—under excessive pressure—it might re-crystallize in its most beautiful allotropic form. It was this idea that I hoped to convey to the reader when I wrote: "The ideal condition, as Mr. Threlfall points out, would appear to be the heating of carbon at a high temperature for a short period with some substance with which it is soluble, and then maintain it at a temperature at which carbon would begin to separate for a long period, and keep it under a high pressure the whole time."

While graphite, under comparatively low pressure (less than one ton per square inch), and at no greater temperature than is caused by its compression, is known to behave physically like a fluid, it cannot be considered, chemically, to be in the liquid state. There would be little hope of its re-crystallizing, upon solidification, in any form other than that in which it existed prior to liquefaction. That diamonds may, however, crystallize at a high temperature is evidenced by the fact that Moissan, in his successful experiments, heated highly carburized cast-iron with carbon in the electric furnace, and quenched the product in molten lead. The iron was afterward dissolved in nitric acid to which chlorate of potash was added; the residue was treated first with caustic potash, and then to prolonged boiling in hydrofluoric acid, followed by similar treatment with sulphuric acid, and finally fusion with caustic potash. The residue remaining from this treatment was carbon—but in the form of diamond. The largest diamond Moissan produced was 0.5 mm. in diameter.

F. H. MASON.

Paso Robles, California, February 22.

Smelter Fume.

The Editor:

Sir—At many smelter-sites the wind blows the greater part of the time from one direction, that is, there is a 'prevailing wind'. It will be observed, when the wind is blowing at a considerable velocity, say, 10, 20, or more miles per hour, that the fume from a smelter will be mixed with a large volume of air, and will be but little noticed in the country over which it passes. If, on the contrary, only a light wind be blowing, or a calm prevail, then the fume is but little diluted, the atmosphere becomes heavily charged with fume, and damage results. With sufficient dilution harm from smelter fume may be largely avoided. This idea may be applied practically. From the site of a smelter, construct a conduit at right angles to the direction of the prevailing wind, in one or both directions, for such a distance as may be required, depending upon the amount of fume produced. At intervals of 100 ft. provide openings from which to permit a small portion of the fume to escape. Thus in the distance of one mile there would be 52 openings from each of which a small amount of fume would escape. Suppose that in the case of a large smelter 10 miles of such conduit would be required. Then there would be 528 openings, from each of which a small amount of fume would escape, and the fume would be subjected to extreme dilution, so that no harm could ensue.

Those who have lived in the vicinity of large smelters will have observed that with a constant wind in one direction, the fume will be carried away with but little spreading out of the smoke-stream. In a distance of 12 or 15 miles I have frequently observed such a stream to be no more than half a mile wide, and still capable of injuring susceptible vegetation. If this volume of fume were emitted through a conduit 5 or 10 miles long, a small amount escaping through each of a number of openings, extreme dilution would result, and no harm could follow. The smoke-stream would be 5 or 10 miles wide at the beginning. Such a conduit would not need to be of large size, since the fume would be forced by blowers at high velocity. The conduit, moreover, would diminish gradually in size.

L. F. BASSETT.

Redding, California, February 25.

MINING METHODS IN THE NORTH.—III.

Written for the Mining and Scientific Press
By T. A. Rickard.

'Drifting' aided by steam-thawing is the mining method characteristic of Alaska and the Yukon. It deserves detailed description.

On the claim known as No. 11 Below Discovery on Cleary creek, near Fairbanks, I had an opportunity of seeing this method applied in a systematic fashion. Henry Riley was in charge of the operations and gave every facility to observe the work in progress. The shaft is 7 ft. square and 70 ft. deep. It is sunk several feet below bedrock so as to serve as a sump for the drainage of the mine and afford the gradient necessary for the easy movement of the cars. To this one shaft comes all the product of the mine, both water and gravel. The former is pumped to surface; the latter is raised in a self-dumping bucket. Fig. 1 gives a plan of the workings, looking up-stream. As soon as the shaft has been sunk, a main level is started in both directions along the creek-bottom. An area 360 ft. long and 250 to 300 ft. wide is then blocked out, preparatory to extraction. Going up-stream the main gangway was 200 ft. long, while in the opposite direction the limit was the old workings. As the sketch shows, the removal of the gravel had resulted in the formation of cavernous openings. At the upper end, two pillars (D and E) had been left in place to hold the ground. Stoping was progressing on each side of the main level, toward the shaft, as indicated by the arrows. From 6 to 7 ft. of gravel is removed and also 1 ft. of the bedrock on which it lies; thus the excavation or room is 7 to 8 ft. high. As the gravel is extracted, the roof thaws, drops, and forms a flat arch. The material falling from overhead forms a slope inclined at about 7° and leaves a void about 5 ft. high, as against the original 7 ft. in the stope. Since the ground when broken should occupy about 1½ times the space it filled before removal, it is a fair inference that the ice in the gravel must represent about 50% of its total bulk, for it is the melting of the ice, and its removal as water, that prevents the caved ground from filling the stopes.

Thawing is done with steam-points. A battery of them in action is shown in the accompanying photograph. They are applied in groups of four or five, united by a cross-head, with a valve for each 'point.' In Fig. 1 the position of steam-points is shown by small stars. The space at A has no points; it is a 16-ft. pillar left to support the roof. In the near stope to the left there were 38, and in the right-hand stope 42, points. The driving of the points is effected with hot water, fed by an injector at about 150° F., so as to keep the aperture clear at the working end. The point is inserted into the gravel just above bedrock and driven forward gently by the tap of a hammer as a way is made by the thawing of the ground. The use of hot water minimizes the amount of steam in the workings and tends to diminish caving. After the points are in position and have been driven to their full length, the steam is turned on. Steam is then passed for 24 to 30 hours. This is the 'sweating' period. If the point is working well, no steam will be seen escaping at the head, for all that is entering the pipe is being emitted at the inner extremity, where the work of thawing is being done.

When the ground has been thawed in this way, the 'points' are removed to another place in the mine and the work of extracting the softened de-

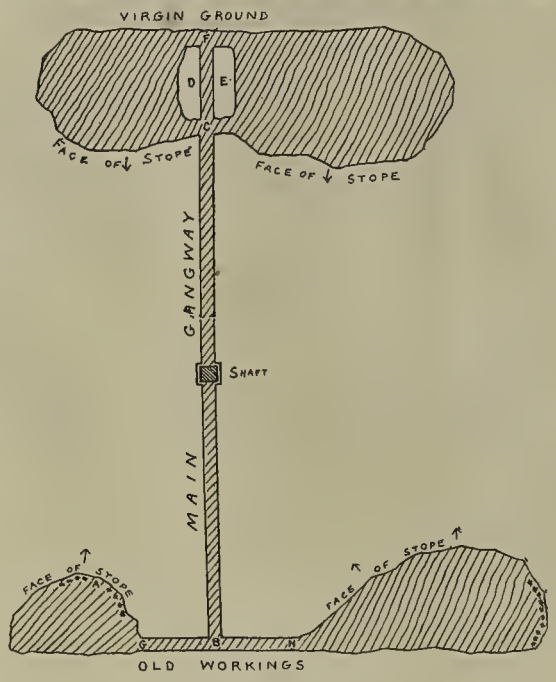


Fig. 1.

posit begins. The gravel is broken with a pick, and shoveled into wheelbarrows. At C and B, where the cross-cuts meet the main level, there is a landing; here the wheelbarrows are emptied into a car, which transports the material to the shaft. The bucket comes to rest below the floor of the level and

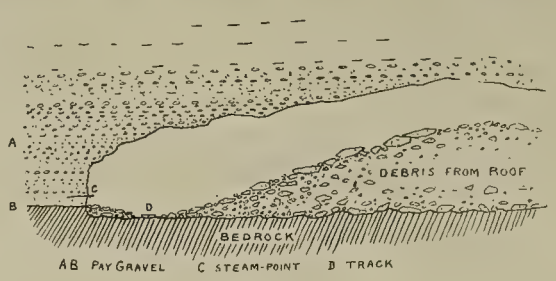


Fig. 2.

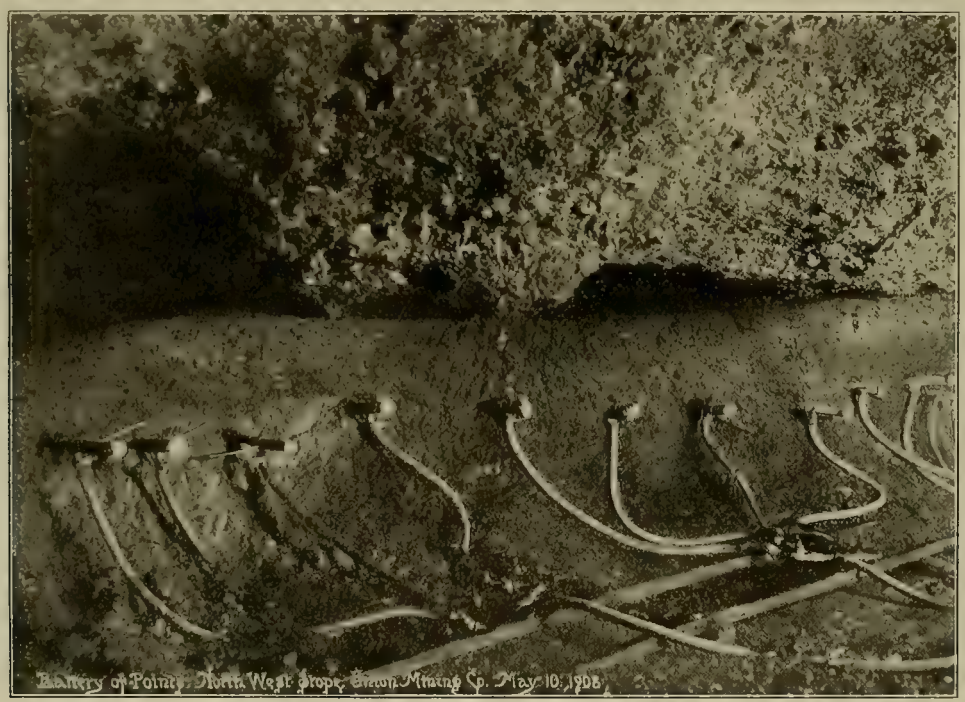
the car is discharged into it. The men trundling the barrows have to maintain a regular gait, for there are six of them on each side and they have to advance in procession. Each man picks, shovels, and wheels his own share of the gravel. At the time of my visit, on August 5, the total force numbered 44 per day; of these 30 were working in the mine. The miners are paid $5 and board; the hoist-men, $6 and board. Two point-men work 10 hours by day and one point-man works for the same length of time by night; each of these is paid $7 and board. Board is worth $3 per day. All the main gangways are tim-

bered, but there are no collar-braces. The top and sides are lagged with round poles.

The method of mining is fundamentally a modified long-wall system, the ground being allowed to cave in the rear as the working-face is advanced. The air is like that of a cold-storage plant. As the visitor goes through the workings he hears and feels the effects of the thawing, for the distant thump of dropping gravel may be accentuated by a tap on his own shoulder as a pebble performs the duty allotted to it by the immutable law of gravity. To avoid danger, it is well to keep close to the frozen face and avoid all cavernous spaces. The use of a steam-point, as compared to the old wood fire, localizes the thawing and does not heat the air of the workings so as to cause the arch to collapse too fast. When burning wood, the air was warmed and the roof of the working tended to cave suddenly. But at its best this thawing with steam is a dangerous method. It is necessary to take chances, for the presence of interstratified layers of ice may cause big slabs of gravel to fall. As a rule the cracking of the ground affords a warning. Protection for the miners could be obtained by using a stull with a head-board, at intervals, where gravel is being removed. This temporary timbering could be pulled out as the work progresses.

Any gravel supposed to be worth less than 2 cents per pan, that is, $2.75 to $3 per yard, was not mined. This was stated to be the economic limit.

A few days later, on Esther creek, I saw several good examples of this type of mining. One of the best was on the Reutter fraction next to Claim No. 3 Below Discovery. John Jesson was in charge and explained his operations clearly. A sketch of the workings is shown in Fig. 3. The shaft is 88 ft. deep to bedrock and is then continued 12 ft. deeper into the bedrock, so as to facilitate drainage and grade. The main drift A B runs up and down the longer axis of the gravel deposit lying on the creek-bottom. Cross-cuts E F, G H, K M, C D, are extended at regular intervals to the limit of the pay. The shaft is 6 by 6 ft. in the clear; the drifts are 6 ft. wide and 6½ ft. high. Bedrock is soft schist; in places it has been disintegrated to the condition of clay. The gold has penetrated the bedrock; in places it is profitable to dig 18 in. The alluvial deposit is topped by 30 to 40 ft. of muck, most of it being ice. The underlying gravel and débris carries a little gold all the way down to bedrock, but on the bottom there is a layer rich enough to warrant extraction. A thickness of 3 to 7 ft. is mined. The width, across the creek-bottom, reaches in places to a total of 600 ft. and it is doubtful whether it does not connect with a bench deposit that is 400 ft. more. The mine, as I saw it, had workings reaching laterally for 180 ft. and lengthwise for 250 ft. The intermediate cross-cuts (G H and K M) are called 'emergency tunnels.' In case the main stopes are lost, by reason of caving ground, so as to stop extraction, these additional avenues enable a new working-face to be started. Extraction proceeds in a wedge-shaped room or stope, the outer end (as at G, N, O, and P) being kept far ahead of that portion of the stope which abuts against the main gangway. The purpose of this is evident: it protects the main artery of the mine and also the main entrance (the shaft). When the block of ground is worked out there survives a diamond-shaped or rhomboid remnant around the shaft. Successive advancement, as the stopes enlarge, is indi-



Steam-Points in Action Underground.

cated by the dotted lines. In case of a cave, such as is illustrated by the area A B C D in Fig 4. a new cross-drift. E B, is driven from the main gangway, in order to reach the uncaved part of the stope.

Steam-points are used in the ordinary way. From 35 to 40 of them are inserted in the face of one room, while picking and shoveling is going on in the three other rooms or stopes. The points are placed 2 to 2½ ft. apart.* They are 8 ft. long and thaw the ground for 2 ft. beyond their inner extremity. They thaw a thickness of 4 to 5 ft. Therefore the duty of each point is 100 cu. ft. or nearly 4 cu. yd. They are allowed to sweat for 24 hours. While the point is being driven into the gravel, it is fed with water forced by a Worthington pump and having a temperature of 120° to 200° F.

The air underground is chilly. In one stope I saw a layer of ice on the bedrock. In vertical seams traversing the overlying gravel, I saw slabs of ice projecting. The clear ice melts slowly and survives after the frozen gravel has disintegrated.

The force engaged in this mine during the day shift consisted of 18 laborers at $5, 1 point-man at $6, 1 man at the dump-box at $6, 1 man at the boiler at $6, 1 foreman at $10; while at night there were 1 point-man at $7 and an assistant at $6; also 1 boiler-man at $5. In each case the cost of board (about $3) must be added to the wages specified, for the operator feeds the men, and he feeds them well. Most of the thawing is done at night. Wood costs $8.50 delivered and 5 cords are used in the 24 hours.

There were 22 men underground at the time of my inspection. Each laborer engaged in moving gravel is expected to make 100 trips with his wheelbarrow in his 10-hour shift; this is equivalent to 10 cu. yd. The barrow-men come out of the stope in regular order, in three crews of six each. Six barrows fill a bucket. The bucket-tender at the shaft pulls a wire that rings a bell in the main drift and this serves as a signal notifying the barrow-men when they are to start in procession toward the shaft. This is so timed that the loaded barrows meet the bucket on its descent; thus the whole performance is intelligently regulated.

The clean-up takes place weekly. The riffle-poles are worn out and require replacement in a month. The gold is 861 to 863 fine. It travels 50 to 60 ft. down the sluice-boxes. Of these there are 10; each is 18 in. wide and 12 ft. long. The dump-box is 32 ft. long, 3 ft. wide, and 2 ft. deep. The total length of gold-saving apparatus is 152 ft. About 350 oz. are obtained as the result of a week's work.

The largest operation by drifting and thawing in the Fairbanks district was on No. 8 Below Discovery on Esther creek, where Clarence J. Berry and J. H. Hamil are conducting systematic work. To Mr. Hamil I owe the opportunity of seeing this interesting mine. (See Fig. 5.) It is entered by two shafts, placed at an equal distance from the dump-box, which is at the head of the sluices that extract the gold from the gravel. A block of ground 640 ft. long and 400 ft. wide, is divided into four parts by the central position of the dump-box and the sinking of shafts midway between this centre and the extremities of the ground to be attacked. This is shown in the sketch (Fig. 5). At a distance of 40 ft. on each side of each shaft, a stub-drift is made; and at intervals of 50 ft. similar stubs are dug, allowing just room enough for a car. The profitable portion of the creek-bottom has a width of 400 ft., therefore the main drift has 200 ft. of ground on each side. The claim is located across the creek, so that it covers 660 ft. lengthwise and 1320 ft. across. This is unusual; ordinarily the longer measurement is up and down the creek. A cross-drift is run from the main drift along the end-line for a distance of 150 ft. each way and then stoping is begun, widening for 50 ft. more to the pay (Fig. 6). Thus a triangular area, A B C, is worked out, extracting the gravel farthest from the main drift. Then if the roof caves, as is likely, the working face is lost, usually at D. Now the stub-drift at H comes into play. A new cross-drift is extended from G to the caved stope, cutting into it at E. Then the block E B G F is mined. This leaves a triangular area, F G H, next to the main gangway, serving to protect it until the next stub-drift, at K, is brought into action. Finally the remnant F G H is mined and the ground allowed to settle, as it will. As the mining proceeds, the overlying gravel caves up to the covering of muck. The roof cracks and breaks away slowly. A warning is given by the ripping noise. Short stulls are placed in dangerous places, so that the crackling of the timber may give warning to any men close-by.

In driving the main drift it is customary to use steam-points, but the trimming of the drift is effected with a Worthington pump, using a half-inch nozzle. Then a set of timber is erected and the track laid. Sills are spread for the first 40 ft. from the shaft; after that the posts are set in the bedrock itself. There is danger of loosening too much ground if steam-points are used too freely, especially in the roof. Moreover, the thaw due to a point spreads unevenly, hence the employment of a small nozzle.

Thawing is done with steam-points 10 ft. long. They thaw 2 to 4 ft. beyond the inner end and through a vertical height of 4½ to 5 ft. They are placed 2½ to 3 ft. apart. Therefore the average duty of a point is 170 cu. ft. or about 6 cu. yd. The gravel is shoveled into a low car. The distance from the track to the top of the car is 32 in. and the capacity of the car is 18 cu. ft. The car holds the contents of six wheelbarrows or one self-dumping bucket.

The shaft is 90 to 92 ft. deep. In sinking, 42 to 45 ft. of muck is first cut. Sometimes a seam of sand is intercalated. The bedrock is a soft schist. In places the schist is blocky and then the yield of gold is best, reaching into the crevices for a depth of 2 or 3 ft. When the schist is soft as mud, the returns are low. From 3 to 3½ ft. of bedrock is mined. Usually 6 to 8 inches would include all the gold, but the uniform removal of bedrock to the depth mentioned is required to keep the floor level, the surface of the bedrock being uneven. The gravel itself carries but little gold; the metal is practically all on, and in, the bedrock. Mr. Hamil informed me that

*Sometimes the 'points' are placed as much as 5 ft. apart.

the overlying 40 to 45 ft. of gravel contains fine colors of gold, but as it is rarely tested no accurate information is available. The width of the gold-bearing channel varies suddenly at different places along Esther creek. On the flat a quarter of a mile below No. 8 claim the 'streak', as the width of pay is termed, is 1000 ft. wide and yields 75 cents per square

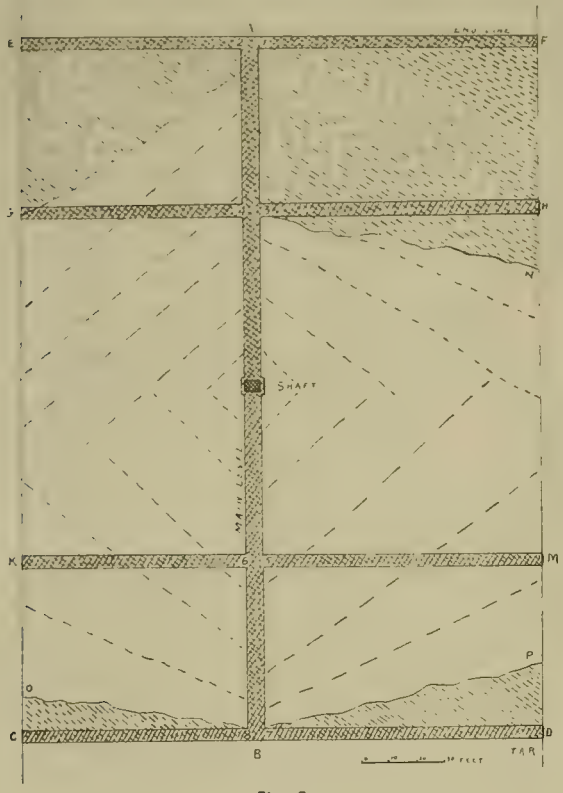


Fig 3.

foot of bedrock. It has been tested by shafts and cross-cuts. On No. 7 Below the pay was only 150 ft. wide at the upper end-line and 400 ft. at the lower end-line, 1000 ft. apart. On No. 8 the channel widens until the edges of it are unprofitable.

The sump at the bottom of the shaft is sunk 15 ft. into bedrock. No live water is found. The same

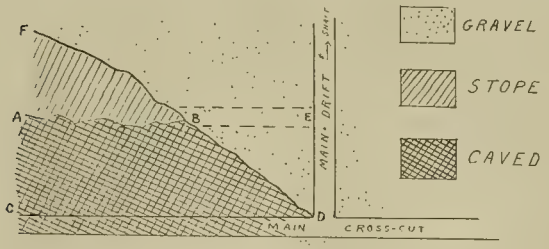


Fig. 4.

engine and engineer work the buckets from both shafts, the discharge of gravel being made alternately. The dump-box tends to store the gravel so that it is not all washed down the sluice-boxes right away, and it seems proper to ask why it is not possible to arrange for the systematic feeding of the gravel into the washing apparatus. Near the north shaft I saw a dump in which four steam-points were at work thawing the gravel accumulated during the previous winter. This was on August 8. The steam was conducted in a half-inch pipe for 150 ft. without any covering and connected with 200 ft. of pipe wrapped with asbestos packing and canvas. The radiation of heat was visible in the vibrating air.

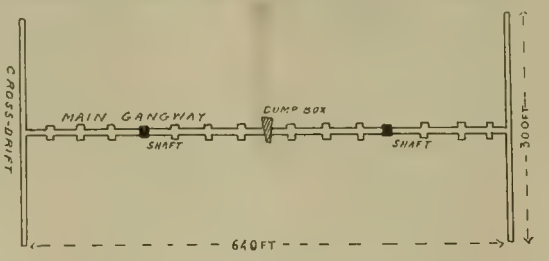


Fig. 5.

Slabs of ice and patches of snow lay uncovered at the foot of the dump, where shoveled the night previous. The water from the sluice-boxes is re-used.



Self-Dumping Bucket Discharging on the Apron Above Dump-Box.

It runs into a ditch and is pumped back into the dump-box. This water, used for saving gold, is thick with mud and no effort is made to settle the slime. These criticisms are made because this was the best-managed drift-mine that I saw in the North and the

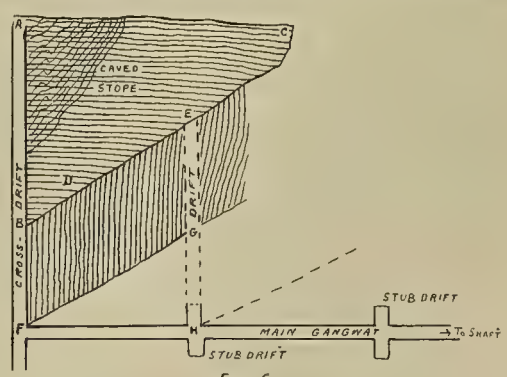


Fig. 6.

skillful operators who are doing the work are well able to meet such friendly comment.

Before beginning extraction of gold by sluicing, the development and equipment of this mine cost $35,000.

OIL MEASURES IN THE COALINGA DISTRICT.

Written for the Mining and Scientific Press
By William Forstner.

The Coalinga district has within the last few years taken rank as a prominent oil producer in California. This district can be divided into two portions: the Coalinga field proper, and that portion of the district lying south of the Coalinga field, extending southward to the Antelope valley. These two portions are separated by a stretch of country lying between the Waltham and Jacalitos creeks, wherein considerable disturbances of the formations render it quite impossible that commercially valuable oil deposits will be found. The Coalinga field proper lies north of Waltham creek, and is actually developed and producing oil over a distance of 15 miles north and south, and over a width varying from 1 to 2 miles. The stretch of country south of the Jacalitos creek, to the Antelope valley, 32 miles long, will be herein referred to as the Kreyenhagen field. In this field development is in progress, and numerous investments have been made.

Until last fall the only publication treating of the geology of this region was: 'A Stratigraphic Study in the Mount Diablo Range of California,' by F. M. Anderson, Proceedings of the California Academy of Science, 3rd. series, Vol. II, No. 2. In this treatise nothing, however, was stated regarding the occurrence of oil. The U. S. Geological Survey has made an examination of this region, and in the fall of 1908 the results were published in *Bulletin* No. 357, 'Preliminary Report on the Coalinga Oil District', by Ralph Arnold and Robert Anderson.

In discussing the probabilities of finding commercially available oil deposits within the Kreyenhagen field this report expresses an unfavorable opinion. An opinion stated by such an authority must carry weight, and being unfavorable, would tend to discourage investment for the development of a region so condemned. After a careful study of this region I have come to the conclusion that this opinion is more unfavorable than is warranted by the conditions.

On the east slope of the Mount Diablo range we find strata belonging to all the series included between the Franciscan and the Quaternary. The Cretaceous, Eocene, and Miocene formations occur in disconnected bands or lenses, showing that the subsidence of various parts of the region, or their erosion during the periods of uplift, were not uniform. There are in the Coalinga district two belts of brown shale, weathering white or light-yellow, forming conspicuous features in its topography; one of these belts is of Eocene and the other of Middle Miocene age. These shales are believed to be the source from which the oil is derived, not only in this, but also in other fields in California. There is a marked difference between the distribution of these shales in the Coalinga field proper, north of Waltham creek, and in the Kreyenhagen field, south of Jacalitos creek. In the Coalinga field the Eocene shales are prominent, while the Miocene shales are absent, the Middle Miocene being represented in this part of the district by sands and clays (*Bull.* 357, pp. 36, 37). In the Kreyenhagen field the Middle Miocene brown shales form a very prominent feature; their outcrop can be followed uninterrupted from the Jacalitos creek to the Antelope valley, a distance of 29 miles. They are underlaid from the Jacalitos to Little Tar canyon, in Sec. 35, T. 23-17. It must be noted that the canyon called Little Tar in the map of *Bull.* 357, is the Esperanza canyon, and that Little Tar canyon lies about half-way between Esperanza and Big Tar canyons, by the Lower Miocene Vaqueros formation. Farther south this is probably overlapped by the Middle Miocene, and does not show again at the surface until east of the Devils Den. The Eocene shales are found only in this field, underlying the Vaqueros, between the main fork of the Zapatos creek, Sulphur Spring canyon, and Little Tar canyon, and are not found at the surface north or south of this exposure.

In defining the possible oil territory in this field Arnold and Anderson have started with the premise that: "The shale in the upper part of the Tejón is thought to be the source of the petroleum found in the Coalinga district. * * * Petroleum has not been found in this district except in beds associated with the Tejón and where the Tejón is absent the beds of the other formations are dry" (p. 28). They base this statement on the following:

(1) That the oil in the Coalinga field, the only proved part of the district, is derived from the Eocene, and (2), that in the Kreyenhagen field the oil seepages are found in the Tejón sands or in the Vaqueros, and not in the sands overlying the Miocene shales. As to the first, it has already been shown that the Miocene shales are absent in this part of the district. And as to the second, west of the Miocene shales the formations are cut by deep gulches and exposed at considerable depth; at these points the seepages are found. On the east slope of the Miocene shales the inclination of the strata is less, the surface is to a great extent covered by debris, and the canyons cut only to the solid rock, but hardly into it. The absence of seepage may be due to topographic causes. In a large portion of the Kreyenhagen field the Miocene brown shales are overlaid by a wide belt of clay shales, which may locally have prevented the accumulation of oil in the overlying sands. There is a belt of oil sand east of, and in a general way parallel to, the Miocene brown shales, which can be followed from the Jacalitos to a point east of Dagany Gap. This is probably the sand to which Arnold and Anderson refer as "supposed oil sand outcrop" (p. 111). I have taken a number of samples of this sand, tested them with chloroform, and obtained the following results:

LOCATION.	Reaction.
North line of Sec. 4, T. 22-15, bed Jacalitos creek.	Slight.
Sec. 24, T. 22-15, bed Zapatos creek.	Good.
Sec. 28, T. 22-16, bed Canoas creek.	Slight.
SE. ¼ Sec. 16, T. 23-17.	Very slight.
SW. ¼ Sec. 15, T. 23-17.	Very good.
Same locality, farther south.	Very slight.
W. ½ Sec. 23, T. 23-17.	None.
NW. ¼ Sec. 6, T. 23-17.	None.
NE. ¼ Sec. 17, T. 24-18, near road from Dudley to Lemoore.	None.

I have further taken a number of samples of the Miocene brown shales in the Kreyenhagen field, and for comparison two samples of the Eocene brown shale in Big Tar canyon, where an important seepage is found, and where two wells have proved the existence of oil. Besides testing these samples with chloroform I had a microscopical examination made of some of them by W. Harold Tomlinson of Germantown, Pennsylvania.

LOCATION.	REACTION.	PETROGRAPHICAL ANALYSIS.
Eocene shale, Big Tar canyon, lower strata.	Slight.	Argillaceous; hydrated iron oxides and globules of bitumen.
Eocene shale, same location, upper strata.	Medium.	Argillaceous; glauconite casts; bitumen markings along lines of strata; bitumen globules.
*Miocene shale, Upper Jacalitos, near Devil's gorge.	Good.	
*Miocene shale, at West Fork, Zapatos creek.	Medium.	
*Miocene shale, Main Fork, Zapatos creek, upper strata.	Medium.	Argillaceous; glauconite casts; globules and lines of bitumen.
*Miocene shale, same location, lower strata.	Slight.	Argillaceous; glauconite casts; bitumen stainings along lines of strata.
Miocene shale, Big Tar canyon.	Slight.	Argillaceous shale.
Miocene shale, west of the Devil's Den Co. oil well.	None.	Clay base, diatom spicules and tests, glauconite.
Miocene shale, north of the Devil's Den Co. oil well.	None.	Silicious shale; diatoms.
Miocene shale, Pyramid hills, between Esperanza canyon and road from Dudley to Lemoore.	Slight.	Argillaceous; glauconite and bitumen.
Miocene shale, Pyramid hills, east rim, west of the Pluto oil well.	None.	Silicious, diatomaceous, shale; butumen stains along fractures; globules of bitumen.

*There are no Eocene shales underlying these four samples of Miocene shales; in the Devil's gorge the Vaqueros rests on the Cretaceous, and in the two gorges of the Zapatos no Eocene brown shale was found.

The above shows conclusively that a great similarity exists between the Eocene and the Miocene shales, which is also recognized by Arnold and Anderson (pp. 23, 38). It cannot be denied that both have been deposited under similar deep sea conditions, conditions favorable for the production of oil, as the minute marine organisms have probably been the main source of the oil. In other parts of California the origin of the petroleum is ascribed to formations of similar character, of different age than the Eocene, and all conditions point to the diatomaceous or foraminiferal nature of the deposits as the determining factor in the occurrence of oil, rather than to the age of the formations (ibid. pp. 28, 29). Mr. Tomlinson writes me that the glauconite, which occurs in most of the shale specimens, is usually supposed to possess an organic origin.

We have then here a belt of brown shale, showing in many places organic remains, overlaid by sands giving in places reactions for bitumen, and it must be noted that all my samples were taken from the surface. This shale-belt varies in width from 50 to 2000 ft., and I cannot see any reason for denying its oil-producing possibility. The argument for the underlying similar Eocene shales rests on the presence of oil seepages close to their border, and in the fact that several wells, drilled in former years in the Eocene, have proved that it is oil-bearing, although, due to the steep dip of the strata, they have not been commercially remunerative.

The territory east of the Miocene shales has not yet been tested. Three wells are being drilled in that part of the Kreyenhagen field: the Golden Crest, in Sec. 12, T. 22-15; El Cerrito, in Sec. 14, T. 23-17; and Pluto, in Sec. 19, T. 25-19. The results will furnish data to decide whether the unconditional condemnation of the Kreyenhagen field as a possible oil producer is correct or not. Until then opinion as to future possibilities of the territory must be speculative. In justice to Arnold and Anderson, it must be stated that *Bulletin* No. 357 is only a 'Preliminary Report' on the Coalinga district. A great amount of money is being expended in the development of this field.

Lead in alloys offers some difficulties in analysis. Elborne and Warren announce a process depending on the insolubility of $PbCl_2$ in alcohol, the chlorides of most other metals (Pb, Sb, Cu, Fe, Zn, etc.) being soluble. 1 gm. of the alloy in fine shavings is treated in the cold with 50 c.c. concentrated HCl, and a slow current of Cl passed through for 24 hours. Such a current of Cl may be generated by the action in the cold of concentrated HCl on lumps of pyrolusite. Occasional agitation of the flask containing the alloy may be necessary. With some refractory alloys an occasional heating may prove desirable. After solution has been effected, evaporate the solution in a small weighed porcelain dish over a water-bath. Cool, then pour over it absolute alcohol, stir, and immediately pour off through a dry weighed filter-paper. Repeat three or four times. Finally dry the dish and filter at 100° for 3 hours and weigh $PbCl_2$.

CYANIDING SILVER ORE IN HONDURAS.

Written for the MINING AND SCIENTIFIC PRESS
By GEORGE E. DRISCOLL.

At San Juancito, Honduras, the New York & Honduras Rosario Mining Co. has recently changed the system of ore treatment from pan-amalgamation and concentration to an all-slime filter-press cyanide system, concentration and amalgamation being discontinued entirely. As the ore is of a kind that a few years ago would have been considered unsuitable for treatment by cyanide, and as the results have been successful, a description of the changes made in the reduction plant and in the process may be of interest.

The ore is dumped over grizzlies at the mine, the coarse going to a sorting floor. It is washed and the waste rejected. The large pieces are crushed to about one inch, dropping from the crushers into a bin. The crushed ore is loaded into tram-buckets for delivery to the mill. The wash-water carries a large amount of slime in suspension, and to recover it, lime is added, the water being then settled in vats. The capacity of the vats at the sorting plant is not sufficient completely to settle all the slime produced by washing the ore; the overflow carrying away an extremely fine and light material, amounting to about 2¼ tons per day of 12 hours. This is collected at the mill and is treated apart from the ore.

At the mill the tram-buckets empty into a hopper above the ore-bin, from which the ore is drawn into a car and is weighed before being emptied. The car employed holds about 1400 lb. From the bin the ore passes by inclined chutes into Challenge automatic feeders at the stamps.

The stamps are 50 in number and weigh 750 lb. each when newly shod. The drop is 6 inches, 100 to 102 times per minute. The mortars are of the double-discharge type, with screens of 30-mesh steel wire-cloth. The stamp-duty is 2 tons per stamp per day of 24 hours. The ore is crushed in cyanide solution. Under the former system of treatment the pulp from the batteries flowed to two sets of pointed boxes; the classified product being concentrated on 12 Wilfley tables, the coarse product from the first box passing over an amalgamated copper-plate. Lime is added to the pulp after leaving the batteries.

The overflow from the last boxes was formerly conveyed to two conical bottomed settling-boxes with bottom-discharge, which de-watered and thickened the pulp for concentration; the tailing from the slime concentrators was also elevated by a centrifugal pump and passed over 12 canvas tables. The tailing from the canvas and Wilfley tables was all conveyed to a 4-in. centrifugal pump and elevated to a launder which discharged into the pan settling-vats, the coarse sand being first separated and fed to two Smidt tube-mills. The sand from the tube-mills was re-concentrated, the material settling in the vats was treated by pan-amalgamation, and the slime overflowing from the settling-vats, amounting to 15 or 20 tons daily, was conveyed to the cyanide plant.

This treatment was costly and complicated, while the best extraction obtainable was 86%. In the summer of 1907 the company decided to adopt the cyanide process exclusively, and a 60-leaf slime-filter was purchased from the Charles Butters Co. The cyanide plant was enlarged to treat the entire output from the mill. On March 8, construction being completed as far as possible, with the works in operation, the mill was hung up to permit the final work to be done. The mill was stopped only six days; except for stops for a few trifling changes of a mechanical nature, which were made after starting, the mill has run constantly since, and the process has been pronounced a success.

The ore is crushed through 30-mesh screen in cyanide solution, and flows in wooden launders to a 4-in. centrifugal pump which elevates the pulp to three conical classifiers. The coarse sand is delivered to two tube-mills; the slime overflowing from the cone goes to two circular wooden settling-vats with peripheral overflow. The clear solution overflows into a vat to which is connected a 3-in. centrifugal pump; as the solution accumulates, the pump is started and the solution is raised to the mill-tank, from which it flows by gravity to the batteries to be re-used. From the tube-mills the sand is returned to the cones for classification, the final product going to the cyanide plant. This consists of material of which 90% will pass a 200-mesh screen. About every hour the slime in the settling-vats is drawn off and discharged by gravity into a wooden launder, which conveys it to the cyanide plant. This consists of 7 circular wooden agitator-vats, and two receiving vats, into one of which the pulp from the mill flows. The approximate capacity of the agitator-vats is 50, and of the receiving-vats 90 tons each of dry slime. The pulp from the mill flows into one of the receiving-vats, cyanide being added as the tank is filling, so that when filled the solution will be brought up to 0.2% strength. From the receiving-vats the pulp is transferred to one of the treatment-vats, where it is agitated from 40 to 60 hours before going to the filter. While being agitated, aeration is accomplished by circulating the pulp with a 6-in. centrifugal pump one hour, twice a day.

Samples of the pulp and solution are taken from the agitator-vats twice daily. These are filtered, the solution titrated, and, if needed, cyanide is added by suspending a perforated tin can, filled with this salt, in the pulp.

The exceedingly fine slime from the washing of the ore proved to be difficult to handle and required a large space to settle it. Attempts were made to utilize pan tanks in the mill, but without success. The only available method was to settle the slime in stone tanks below the mill, where it was de-watered, partly sun-dried, and returned in wheelbarrows to the mill. There it receives a preliminary treatment by agitation in solution in pans and settlers before going to the cyanide plant with the mill slime.

The pulp from the agitator-vats is pumped to one of two filter-vats immediately above the filter-box, into which it flows by gravity. When the filter-leaves are covered, the vacuum pump is started and

clean solution is drawn out until a cake of the thickness of ¾ to 1 in. has formed on the filter-leaves. A valve on the suction pipe is then opened, reducing the vacuum to about 5 in., which is found sufficient to hold the cake on the leaves. The surplus pulp is pumped out of the filter-box, returned to the vat, and the filter-box is re-filled with barren solution. The valve is then closed and cake given 40 min. solution-wash, which is followed by a 20-minute water-wash, after which the vacuum-pump is stopped, water is admitted to the filter-leaves, the cake drops off, and is discharged through a 10-in. pipe from the bottom of the filter-box. The time required for handling a charge is about 2 hours, the charge varying from 12 to 18 tons. The filter is operated by one native workman per shift.

After being in use about 3 months, an incrustation of lime forms on the filter-leaves, rendering them almost impermeable. To remove this the leaves are immersed in a 2% solution of hydrochloric acid, experience here having demonstrated that an immersion of 1 hour in an acid solution of that strength is



General View of San Jacinto, Honduras.

sufficient to entirely remove the lime, and will leave the canvas soft and clean. On being removed from the acid bath the leaves should be washed thoroughly until the acid is entirely displaced; otherwise the canvas will be quickly destroyed. It was found also that leakages in the leaves first occurred under the wooden ribs, and it has been found beneficial to sew a 4-in. strip of canvas under the ribs, this reinforcement adding indefinitely to the time a leaf may be used before undergoing repairs.

Precipitation is accomplished by means of zinc shavings, cut on the premises, six-compartment boxes being employed. The precipitation from the solution may be regarded as perfect. The zinc in the head-box is packed and replenished from the next box daily, the zinc being moved up, and new zinc added to the lower box. The boxes are cleaned out every three or four days, depending upon the richness of the ore treated. The precipitate and the solution from the boxes flow in launders to the sump-vat, into which they are washed through a 40-mesh screen. At intervals the agitator in the vat is set in motion, the pump is started, and the precipitate and solution pumped through a small 40-frame filter-press, formerly used for filtering slime. When the press is full it is opened, the precipitate shoveled into sheet-iron cars and run into a drying-furnace. The cars are usually left in the dryer over night, and a fire is kept burning until the moisture has been reduced to 3% or less. On being removed from the dryer, the precipitate is spread on a cement floor. The entire lot is then passed over ⅛-in. mesh screen, after which it is weighed into lots not exceeding 770 lb. The different lots are carefully sampled and put into oiled canvas sacks, which are boxed and shipped to New York.

The plant produces about 4 tons of precipitate per month, a force of four laborers and one shift-boss being required to attend to the zinc-boxes, cleaning-up, drying, sacking, and boxing of precipitate. The solution entering the zinc-boxes contains an average of 14 oz. silver and 0.12 oz. gold. The out-going solution contains merely a trace of gold and seldom exceeds 0.08 oz. silver.



San Jacinto. Mill of New York & Honduras Rosario Mining Co. in Middle Distance.

Sodium cyanide of 127% strength is used exclusively. After the plant had been in operation a few weeks, potassium cyanide of 98% strength was tried, but the results were so unfavorable, in extraction and precipitation, that the use of it was discontinued. A two days' trial sufficed to show the superiority of the stronger sodium cyanide.

In the six months ending October 31, 1908, the plant treated 14,529 tons of ore of an average content of 40.05 oz. silver and 0.467 oz. gold. The tailing averaged 3.43 oz. silver and 0.019 oz. gold. The difference between the actual and theoretical extraction during this period was less than 1%. The cost of material, including zinc, cyanide, lead-acetate, hydrochloric acid, and lime, was ₱5.21, or, at the present rate of exchange, slightly less than $2 gold per ton. The chief item of expense was cyanide, the large amount consumed per ton of ore treated (almost 8 lb.) being due principally to four causes: moisture in the ore and slime, amounting at times to over 10%, which decreases the strength of the solution; to cyanide consumed in dissolving the precious metals; to the presence of cyanicides in the ore, the most active

of which are antimony and copper; and lastly, to loss in precipitation. This last amounts to approximately half a pound of cyanide per ton of solution passing through the zinc-boxes.

As the treatment-costs at present closely approximate the costs when pan-amalgamation and concentration were employed, the advantage of using the cyanide process lies chiefly in the lower labor-cost and in the higher extraction. As the material this plant is treating is a hard quartz, containing—in addition to the gold and silver—lead, copper, iron, and antimony, the results attained should aid in a revision of the opinions held by many writers, that silver ores are not readily amenable to treatment by cyanidation.

Tellurium determination has been subjected to close study by Leuker and Hornberger, whose results are given in detail in the *Journal of the American Chemical Society*. A brief review is given of the different methods proposed. Gutbier's method with hydrazine gave good results but requires slow addition of the reagent, taking too much time. $NaHSO_3$ requires a 24 hr. standing in a warm place, the solution being warm when mixed. A freshly prepared material for the reagent is necessary. SO_2 is also effective if the acidity of the (HCl) solution be fully 10% and the solutions kept hot. Twenty-four hours standing is necessary. By means of a combination of SO_2 and hydrazine, complete separation can be effected in a much shorter time. The Te as TeO_2 or as tellurate in HCl with approximately 10% free acid, is heated to boiling, and 15 c.c. of a saturated solution of SO_2 added, then 10 c.c. of a 15% solution of hydrazine hydrochloride, and again 25 c.c. of saturated SO_2 solution. Boiling is continued until the precipitated Te settles readily. This should not require over 5 minutes. Wash on a Gooch filter until all Cl is removed, then with alcohol, dry at 105° and weigh.

Cold-blast pig-iron, which is still made in Staffordshire, England, is chemically purer than hot-blast, partly because ores of good quality, containing but little phosphorus, are used to feed the furnaces. The cold-blast furnace, moreover, works at a lower temperature than the modern blast-furnace, and smaller percentages of silver, manganese, and other substances are reduced with the iron. The pig costs more to produce by cold-blast, but it brings a higher price, as it yields better castings for such purposes as the manufacture of chilled and grained rolls, hydraulic presses, or where great strength and closeness of grain are of importance. Cold-blast charcoal pig-iron is the purest and toughest made.

Anhydrite occurs in the Cactus mine at Newhouse, southern Utah. The mineral accompanies the chalcopyrite of that copper mine as a primary gangue mineral and is associated with tourmaline and a small amount of calcite and siderite. The hydration of the anhydrite results, of course, in the formation of gypsum, which mineral is abundantly found throughout the mine.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

H. S., Siberia.—Basalt.

W. S. L., Silver Peak, Nevada.—No. 1, magnetite in talc schist; No. 2, hydrous sodium sulphate—mirabilite.

J. H. W., Pioche, Nevada.—Badly weathered rock which was probably a diorite porphyrite or an andesite originally.

S. H. J., El Oro, Mexico.—No. 1, ferruginous quartz; No. 2, altered rhyolite; No. 3, chloritic quartzite with arsenopyrite; No. 4, arkose or granitic conglomerate.

C. H. R., North Fork, Cal.—No. 1, extremely weathered substance with quartz, limonite, garnet, and kaolin; No. 2, pyroxene, epidote, and calcite; No. 3, crystalline limestone with garnet and (wollastonite?).

G. B. U., Stanton, Arizona.—No. 1, epidotized metamorphic sediment—probably an arenaceous shale originally; No. 2, granite pegmatite; No. 3, pegmatitic granite; No. 4, ferruginous quartzite; No. 5, siliceous shale.

C. E. S., Sweetwater, Nevada.—No. 1, dense aggregate of quartz with crystal-lined cavities (more probably vein quartz than quartzite but no certain determination is possible except in the field or on larger, more definite specimens); No. 2, quartz; No. 3, azurite or linarite in quantity too scanty for definite proof; No. 4, weathered pyritized quartzite; No. 5, hematite; No. 6, weathered andesitic lava.

H. L. S., Mexico D. F.—No. 1, pyroxene-amphibole plagioclase rock of porphyritic texture—hence a diorite or gabbro-porphyry; No. 2, gray-green garnets with calcite; No. 3, quartzite with development of garnet and epidote; No. 4, epidote and chalcedony with limonite and manganese oxide; No. 5, a lava with pellucid plagioclase and brilliant hornblende phenocrysts with a small amount of quartz set in a felsitic groundmass—hence, probably, a basic rhyolite; No. 6, biotite granite; No. 7, marble or crystalline limestone; No. 8, pyrite in altered granite; No. 9, porous quartz with limonite; No. 10, quartz-calcite-garnet rock with pyrite; No. 11, metamorphosed granite or granite-porphyry; No. 12, garnet in porous metamorphic rock; No. 13, crushed granite; No. 14, green garnets and calcite with chalcopyrite and hematite; No. 15, amphibole granite with pyrite; No. 16, weathered and metamorphosed granite; No. 17, basalt; No. 18, contact phase of granite with development of green garnet and pyrite; No. 19, impure limestone; No. 20, quartzite; No. 21, coal—probably bituminous because lighter in weight than anthracite but harder to ignite than many bituminous coals; No. 22, carbonaceous shale.

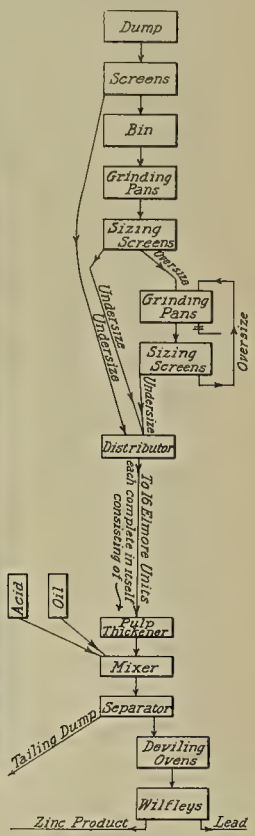
ELMORE VACUUM PLANT.

Written for the MINING AND SCIENTIFIC PRESS
By an Occasional Contributor.

The Elmore 'vacuum' plant for separating metallic particles and sulphides from gangue is tolerably well known to mining engineers and metallurgists, who are naturally watching it with close interest to see how it works in practice. The largest installation yet erected is at the Zinc Corporation's works at Broken Hill, New South Wales, where dumps of zinc tailing are being treated. The plant has been running for about a year and its capacity and possibilities definitely gauged, so some account of its performance will be of interest.



Removing a Dump of Zinc Tailing.



Flow-sheet.

The accompanying flow-sheet shows the operations to which the material is subjected. The material is first sized and such part as requires further comminution goes through a series of wet-grinding pans, so that everything shall pass through a 30-mesh screen. The pulp is divided into 16 parts and is distributed through 16 units of Elmore plant, each consisting of a cone-settler for thickening the pulp to the right consistence, a mixer for incorporating with it the oil and the acid, and a vacuum separating chamber. The concentrates obtained from these separators meet together again and are passed through de-oiling ovens, in which the oil is removed. To obtain more saleable products the concentrate is then passed over Wilfley tables and some of the lead separated. In this way separate zinc and lead products are obtained.

The bulk of the material thus far treated has an approximate assay as follows:

Zinc	20%
Lead	5.75%
Silver	8 oz. per ton of 2240 lb.

The remainder is mostly heavy gangue of rhodonite and garnet, which cannot be separated by ordinary water concentration.

The concentrate obtained from the vacuum plant averages:

Zinc	43%
Lead	11%
Silver	17 oz. per ton.

The treatment on the Wilfley tables produces a zinc concentrate and a lead concentrate assaying as follows:

Zinc Concentrate.		Lead Concentrate.	
Zinc	46.5%	Lead	58%
Lead	7.25%	Zinc	15%
Silver	16 oz. per ton.	Silver	39 oz. per ton.

The actual recovery by the Elmore plant is approximately 90% of the zinc, 73% of the lead, and 85% of the silver. Naturally some of the loss is due to the fact that the sulphides have been partly oxidized. There is also a slight loss on the Wilfleys, but it is not more than about 3%. The sulphuric acid used in the plant is manufactured on the spot and is of the usual commercial quality and the consumption varies from 10 to 20 lb. per ton of the material treated. The oil employed is Texas fuel oil and the consumption varies from 6 to 8 lb. per ton. When the plant was installed it was assumed that the capacity would be 500 tons per 24 hr. or about 30 tons for each unit.

As time went on the daily capacity has been considerably increased and each unit regularly deals with from 40 to 45 tons per day. The amount of labor required is small, for it is only necessary to have one man on each of the three floors to look after the separators, the mixers, and the discharge respectively.

The average costs as given by the Zinc Corporation are:

	s.	d.
Grinding	1	3.96
Elmore plant	2	4.00
Drying and de-oiling	1	3.64
Wilfleys		7.48
Total	5	7.08

In these costs are included: labor and salaries, general supplies, oil, sulphuric acid, power, water, fuel for de-oiling, repairs and maintenance, sampling and assaying, and sundries.

Up to the end of 1907 the plant has treated 150,000 tons and produced 57,000 tons of zinc concentrate and 3000 tons of lead concentrate. It is estimated that a profit is being made of 11s. per ton of material treated. The final figures cannot yet be obtained for several reasons, one being the nature of a contract for the sale of the products.

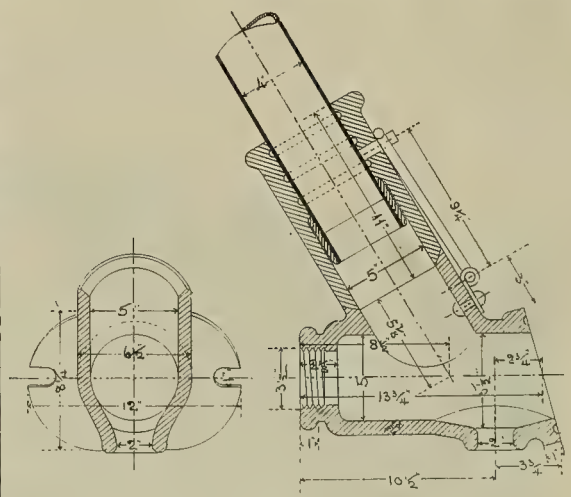
The latest information issued by the Zinc Corporation deals with the results obtained during January. The material treated was 16,560 tons, and the yield was 4845 tons of zinc concentrate and 410 tons of lead concentrate. The estimated contents of the zinc concentrate were 2717 tons of zinc, 397 tons of lead, and 90,597 oz. silver, and of the lead concetnrate 229 tons of lead and 15,990 oz. silver. The estimated income from the products and also of sulphuric acid was £17,415, taking spelter at £20 per ton. The total expenditure, including treatment, management, and royalties, was £7707. The cost of material treated was £4140, so that the net profit for the month was £5568. It should be noted that the lead product is disposed of locally, and that the zinc concentrate is sold in Europe.

A method for determining lead in ores is thus stated by A. H. Low: Treat 0.5 gm. of the ore in the usual manner with acids, finally obtaining a mixture of $PbSO_4$ and insoluble portions of the ore on a 9-cm. filter. Dissolve the $PbSO_4$ through the filter by means of $NaC_2H_3O_2$ solution containing some free acetic acid, running the solution back into the flask in which the ore was originally treated. Add 10 c.c. of a 5% solution of $K_2Cr_2O_7$, boil to granulate the precipitate, filter, and wash but once. Now spread the filter-paper flat, and rinse all the precipitate from it into a beaker, with a hot solution of $H_2C_2O_4$ (1 vol. cold saturated solution to 3 vol. water). Heat nearly to boiling, add alcohol and boil to reduce CrO_3. Filter and wash thoroughly with cold water. Put the filter with the precipitate in a flask with 120 c.c. water and 5 c.c. H_2SO_4. Heat and titrate with standard permanganate. Theoretically, the oxalic ($H_2C_2O_4$, $2H_2O$) value of the permanganate multiplied by 1.642 should equal Pb. In practice the factor 1.669 is more nearly correct.

BLAST-FURNACE TUYERE.

Written for the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN.

The Traylor Engineering Co. advertises a novel blast-furnace tuyere which strongly recalls one designed by the writer in the year 1900, a section of which is shown herewith. The upper end of the four-inch blow-pipe was connected to the bustle-pipe by a swing joint made of two 4-in. 45° ells. Connection was made between the blow-pipe and tuyere by a cast-iron sleeve having a ball and socket, or spherical joint, and the two parts were held together by a link. There was a turned sliding joint between the



sleeve and pipe, and leakage was mostly prevented by so-called air packing grooves turned on the sleeve as shown. It was expected that when the tuyeres were pulled, the link would be thrown off, the sleeve slid up, and the pipe allowed to hang vertically from the bustle pipe. No exact adjustment between the bustle-pipe and the tuyere was needed. For the peep-hole a plug and cap with a sight-hole was provided. A liberal slag-escape was arranged, which would be either closed with a plug of wood or with cotton waste. It was calculated that in the event of the tuyere being slagged, the sight-plug and the sleeve could be taken out and the tuyere in many cases cleaned. The tuyere was flanged and was secured to the jacket by studs, as shown in the transverse section. The design is not patented.

Resistance of surfaces moving through the air, according to experiments recently carried out by Albert Frank, and published in the 'Zeitschrift des Vereines deutscher Ingenieure', when the surface is perpendicular to the direction through which it is moved is 236 times that of the same surface moving through the air when it is parallel with the direction of motion. Thus the resistance offered to the motion of a thin plate normal to the direction of motion is 118 times that of a plate of the same area cutting through the air in a direction parallel to the motion, resistance in this case being offered by both sides of the plate.

MINE-TRACK SWITCH.

Written for the MINING AND SCIENTIFIC PRESS
By R. H. TOLL.

The device described herewith is so simple that I am constrained to apologize for publishing it, my justification being the hope that there may be other mine superintendents who had not thought of exactly this form of switch-tongue and to whom it may prove useful. The nearest approach which I have

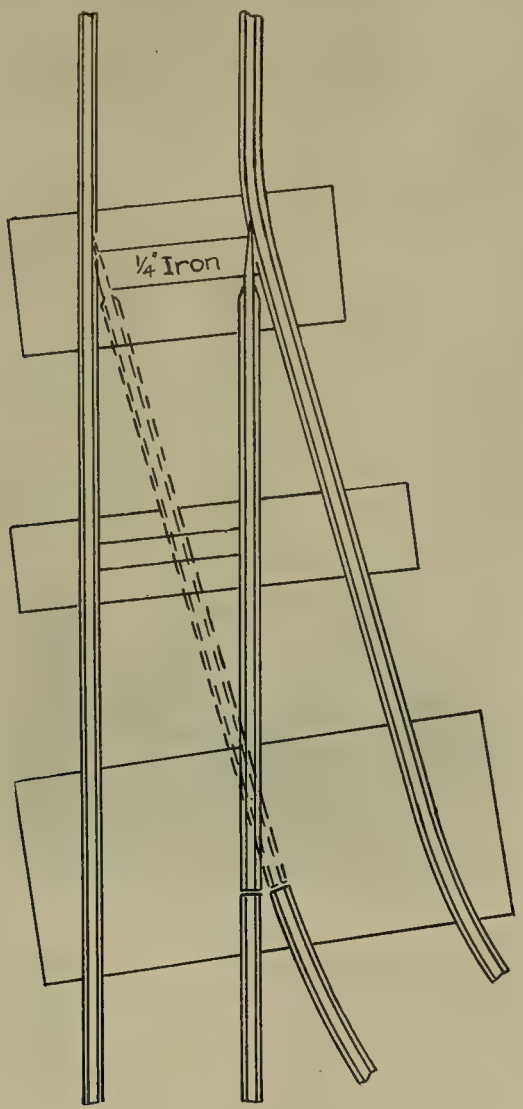


Fig. 1. Mine-Track Switch.

seen to it was at the Congress mine, in Arizona, a number of years ago, where they welded a solid iron block to the butt of the rail, drilled a bolt-hole vertically through this, and countersunk the hole, at a cost of over $2 per switch for extra material and labor.

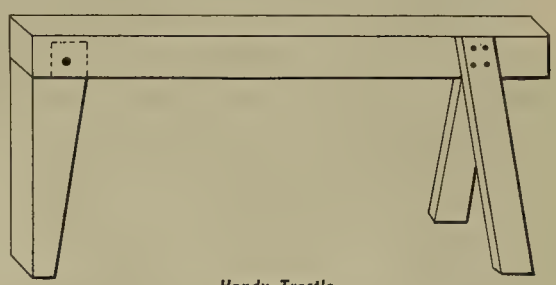
The switch here described may be made in a few minutes by anyone with a cold-chisel and a drill, exclusive of the pointing, which is best done at the mill but may be done quickly at any forge. Cut out one to two inches of the leg of the rail about six inches from the butt, drill a $^{5}/_{16}$-in. hole through the lower flange, and secure it in position by a 60d. or an 80d. wire-nail driven into a tie. It may be necessary to put the spike in the hole in the rail and drive by striking the rail on top. Fig. 2 shows the hole cut in the leg of the rail, the drill-hole in the flange, and the method of trimming the end. Fig. 1 shows the switch in position on a straight track, dotted lines indicating the position on the curve.

It is well to place flat bars of iron on the ties under the switch-tongue to facilitate it sliding; also, to drive a track-spike inside each stationary rail in such position that the head of the spike will tend to hold the point of the switch against the rail and require a slight lift to release it. This form of switch may be used satisfactorily even on sharp curves. Mine-car wheels are so wide that a bend of two or three inches may be made in the switch-tongue, if necessary, without danger of derailing cars.

THREE-LEGGED TRESTLE.

Written for the MINING AND SCIENTIFIC PRESS
By MATT. W. ALDERSON.

The usual form of trestle or saw-stool employed by a carpenter has four legs. When used around a mine in framing timbers and in work of like character,



Handy Trestle.

it is not easy to make it stand solidly without leveling the ground with pick and shovel. This is not always convenient, especially where the ground is rocky or frozen. A preferable form of trestle is one with three legs, as shown in the accompanying illustration. It accommodates itself to inequalities in the surface and stands as solidly as a four-legged

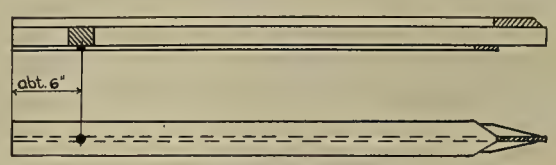


Fig. 2. Switch-Tongue.

trestle under the best conditions. The mine carpenter should have a level place on which to do his work if possible, but sometimes circumstances will not justify this expenditure of time. A trestle of the kind here shown is more handy even in the shop than one with four legs. A board or timber may be sawed off close to the end with the single support without interference, and it facilitates the work of hewing.

Pyridine produces no precipitate in Mn (-ous) salts, but when added in slight excess will throw down $Fe_2(OH)_6$ entirely free from manganese.

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The following table, prepared by Lee Fraser, will be found of assistance in the conversion of metres to feet. The two examples submitted will show the method of operation.

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930.000	3051.1719
1.000	3.2808
0.250	0.8202
0.006	0.0197
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Metres.	0	1	2	3	4	5	6	7	8	9
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3.....	98.42490	101.70573	104.98656	108.26739	111.54822	114.82905	118.10988	121.39071	124.67154	127.95237
4.....	131.12332	134.51403	137.79486	141.07569	144.35652	147.63735	150.91818	154.19901	157.47984	160.76067
5.....	164.04150	167.32233	170.60316	173.88399	177.16482	180.44565	183.72648	187.00714	190.28814	193.56897
6.....	196.84980	200.13063	203.41146	206.69229	209.97312	213.25395	216.53478	219.81561	223.09644	226.37727
7.....	229.65810	232.93893	236.21976	239.50059	242.78192	246.06225	249.34308	252.62391	255.90474	259.18577
8.....	262.46640	265.74723	269.02806	272.30885	275.58972	278.87055	282.15138	285.43221	288.71304	291.99387
9.....	295.27470	298.55553	301.83636	305.11719	308.39802	311.67885	314.95968	318.24051	321.52134	324.80217

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World production (approximate).....	1,095,064
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United States percentage of world production.....	33.3
United States percentage of world consumption....	35.6
World rank of United States in production of lead..	First
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Llamas.

Analysis of llama dung, which is used as fuel in the high plateau of western South America, shows:

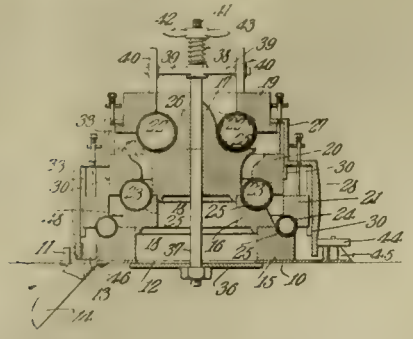
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Average price per ton in Peru is 6.5 soles, equivalent to $3.25 U. S. currency.

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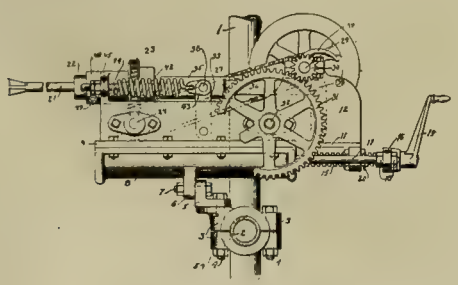
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HAND-POWER DRILL.—No. 911,755. Leroy S. Pfouts, Canton, Ohio.



In a drill of the class described, a base supported in proper elevation, slidable members carried thereby, a drill head bearing carried by said sliding plates and a drill head located therein, and a drill carried by the head, the drill head provided with a worm gear wheel, a worm adapted to actuate the worm gear wheel and drill head, a reciprocating hammer head, means for reciprocating the hammer head, and means for holding the hammer head out of action and means for rotating the dril head and drill independent of the reciprocating movement of the hammer-head, substantially as and for the purpose specified.

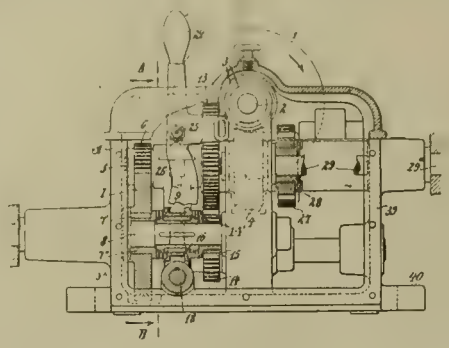
ART OF TREATING ORES.—No. 912,485. Robert McKnight, Pittsburg, Pennsylvania.

The art of treating thorium ores which consists in treating the ore with an alkaline chloride and heating the resulting mixture until volatile and soluble chlorides of the thorium have been formed, condensing what is volatilized and treating the residue with an aqueous liquid, substantially as described.

PROCESS OF MAKING CYANIDE BRIQUETTES.—No. 912,538. Julius Bueb, Dessau, Germany.

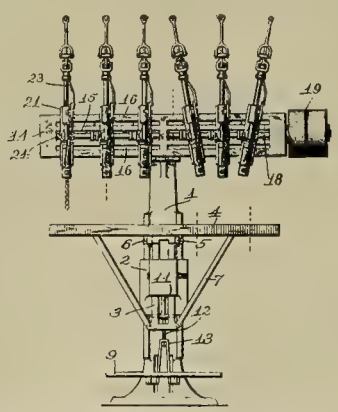
A process of making cyanide briquettes consisting in forming cyanide crystals into briquettes and subsequently heating the briquettes in a vacuum to a degree sufficient only to drive off the water and not sufficient to decompose the cyanide.

MILLING AND LIKE MACHINE.—No. 911,841. Georg Reyher, Berlin, Germany.



An attachment for universal milling and like machines for converting said machine into an automatic machine consisting of a casing or support having means for detachably connecting it with the reciprocating table of the milling machine, a driving member and driving connections supported thereon for giving a forward and backward movement to the table, and driving connections also carried by said detachable support for giving a step by step movement to the dividing head of the milling or like machine, the driving connections first mentioned comprising gearing for giving the forward movement to the table, gearing for giving a backward movement thereto, a clutch with means for operating it to throw into action either one gearing or the other, means for controlling said clutch from the movement of the work table, and the driving connection last mentioned comprising gearing and a clutch operated at a certain point to cause said gearing to move the dividing head with means for throwing said clutch out of operation automatically when the dividing head is adjusted, substantially as described.

BORING-MACHINE.—No. 911,639. Moses L. Andrew, Delhi, Ohio.



A boring machine comprising a horizontal rail provided with a central horizontal slot and with a slot above and below the central one, a splined shaft journaled to the rear of the central slot of the rail, a block fitted to slide in the central slot, a bracket lying against the face of the rail and swiveled upon the forward end of the block and provided with vertical slots across the upper and lower slots of the rail bolts engaging the vertical slots of the bracket and the upper and lower slots of the rail, a vertically movable boring spindle journaled in the front of the bracket, a shaft journaled in said block, bevel gearing connecting the front end of the shaft with the boring spindle, bevel gearing connecting the rear end of the shaft with the splined shaft, and a work-table disposed below the boring spindle, combined substantially as set forth.

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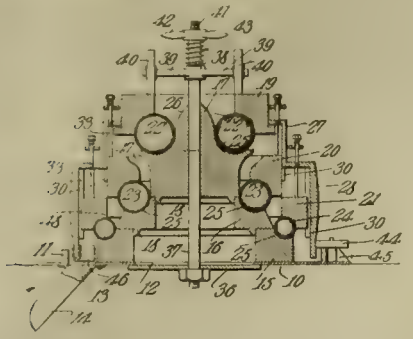
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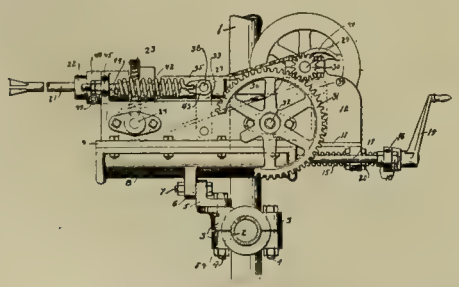
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In a ball mill, an interior winding drum, a revoluble casing, an exterior grinding drum comprising an annular die immediately attached to said casing at the top thereof, another annular die rotatable with but slidable longitudinally of said casing held beneath the first-mentioned die, means to adjust the pressure between the first mentioned die and the interior drum comprising a bolt extending through said interior drum, a collar provided with arms held upon said bolt at the upper end thereof, rollers mounted upon said arms and adapted to bear against said first-mentioned die, a handled nut mounted on said bolt above said collar, and a spring held between said nut and collar, and separate means to adjust the pressure between the exterior die and the exterior drum, comprising a plurality of bolts attached to said casing, yokes carried on said bolts, nuts mounted on said bolts above said yokes, and springs between said nuts and said yokes, said yokes being rigidly attached to the said die.

HAND-POWER DRILL.—No. 911,755. Leroy S. Pfouts, Canton, Ohio.



In a drill of the class described, a base supported in proper elevation, slidable members carried thereby, a drill head bearing carried by said sliding plates and a drill head located therein, and a drill carried by the head, the drill head provided with a worm gear wheel, a worm adapted to actuate the worm gear wheel and drill head, a reciprocating hammer head, means for reciprocating the hammer head, and means for holding the hammer head out of action and means for rotating the dril head and drill independent of the reciprocating movement of the hammer-head, substantially as and for the purpose specified.

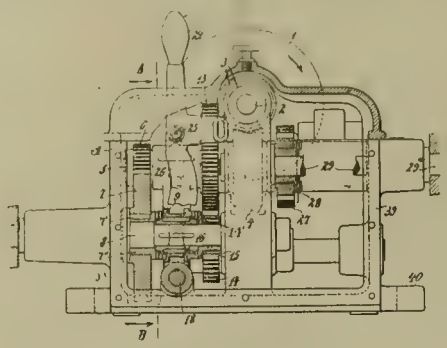
ART OF TREATING ORES.—No. 912,485. Robert McKnight, Pittsburg, Pennsylvania.

The art of treating thorium ores which consists in treating the ore with an alkaline chloride and heating the resulting mixture until volatile and soluble chlorides of the thorium have been formed, condensing what is volatilized and treating the residue with an aqueous liquid, substantially as described.

PROCESS OF MAKING CYANIDE BRIQUETTES.—No. 912,538. Julius Bueb, Dessau, Germany.

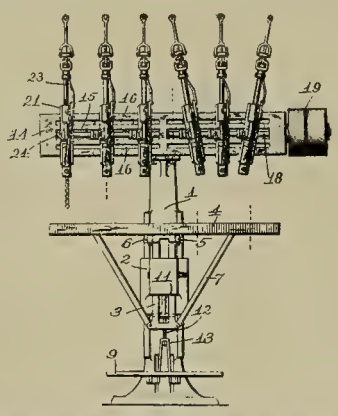
A process of making cyanide briquettes consisting in forming cyanide crystals into briquettes and subsequently heating the briquettes in a vacuum to a degree sufficient only to drive off the water and not sufficient to decompose the cyanide.

MILLING AND LIKE MACHINE.—No. 911,841. Georg Reyher, Berlin, Germany.



An attachment for universal milling and like machines for converting said machine into an automatic machine consisting of a casing or support having means for detachably connecting it with the reciprocating table of the milling machine, a driving member and driving connections supported thereon for giving a forward and backward movement to the table, and driving connections also carried by said detachable support for giving a step by step movement to the dividing head of the milling or like machine, the driving connections first mentioned comprising gearing for giving the forward movement to the table, gearing for giving a backward movement thereto, a clutch with means for operating it to throw into action either one gearing or the other, means for controlling said clutch from the movement of the work table, and the driving connection last mentioned comprising gearing and a clutch operated at a certain point to cause said gearing to move the dividing head with means for throwing said clutch out of operation automatically when the dividing head is adjusted, substantially as described.

BORING-MACHINE.—No. 911,639. Moses L. Andrew, Delhi, Ohio.



A boring machine comprising a horizontal rail provided with a central horizontal slot and with a slot above and below the central one, a splined shaft journaled to the rear of the central slot of the rail, a block fitted to slide in the central slot, a bracket lying against the face of the rail and swiveled upon the forward end of the block and provided with vertical slots across the upper and lower slots of the rail bolts engaging the vertical slots of the bracket and the upper and lower slots of the rail, a vertically movable boring spindle journaled in the front of the bracket, a shaft journaled in said block, bevel gearing connecting the front end of the shaft with the boring spindle, bevel gearing connecting the rear end of the shaft with the splined shaft, and a work-table disposed below the boring spindle, combined substantially as set forth.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

AIDS TO SHIPPERS is the title of an unusually valuable compendium of information compiled and published by Oelrichs & Co., 5 Greenwich St., New York. It gives instructions concerning packing and marking goods for ocean shipment, consular invoices, customs entry, drawbacks, insurance, lighterage, and the like. The tables are equally useful, comprising conversion of metric into United States weights and measures, and values of foreign coins in great detail. A large array of foreign weights and measures is gathered into the most elaborate table of the kind we have ever seen. While going to such lengths it seems unfortunate that it was not made even more thorough. For example, the Spanish and Spanish American *almud* is entirely omitted; the *manzana* is given only for such small countries as Costa Rica, Nicaragua, and Salvador; *ganado* and *caballeria* are not included, and other lack of judgment is displayed in this collection. But it is nevertheless a remarkable little book, and will be of great use to all persons going to foreign parts.

HYDRAULIC TABLES: THE ELEMENTS OF GAGINGS AND THE FRICTION OF WATER FLOWING IN PIPES, AQUEDUCTS, SEWERS, AND OTHER CONDUITS. By Gardner S. Williams and Allen Hazen. 2d. ed., 8vo., pp. 104. New York: John Wiley & Sons. 1909. Price $1.50.

These famous tables are presented with careful revision, and may be assumed to have eliminated errors as thoroughly as may be possible. A further explanation of the Hazen & Williams formula, as to the last term, is given; also additional new matter appears in relation to submerged weirs. Other expansions have been made in the text relative to weirs, this feature of the book being one that will meet with cordial welcome by all engineers. The work is a necessary adjunct to the equipment of any man having to deal with hydraulic problems.

TEMPERATURE ENTROPY DIAGRAM. By Charles W. Berry. 2d. ed., revised and enlarged, 8vo., pp. 290. New York: John Wiley & Sons, 1908. Price $1.25.

This admirable treatise has been of great service to all students of thermodynamics, and to engineers dealing with the application of steam and gas and hot air in power-development where high efficiency is sought. The book is intended as an introduction to the advanced study of thermodynamics. The discussion is illustrated by diagrams. The chapter on the flow of fluids has been re-written and treats at length of the irreversible process. One chapter deals with mixtures of gases and vapors, and another describes the principle and use of F. Mollier's total energy-entropy diagram.

TEXT-BOOK OF PETROLOGY. By F. H. Hatch. 8vo., pp. 404, ill. London: Swan Sonnenschein & Co. New York: The Macmillan Co.

This is the fifth edition of a little book that has proved most useful; it contains a summary of the modern theories of rock-origin, a description of the rock-forming minerals, and a synopsis of the chief types of igneous rocks, as illustrated by their distribution in the British Isles. The author describes the mineral constituents and internal structure of igneous rocks, their mode of occurrence at the surface, and their origin beneath the exterior of the earth. The book has won well deserved success.

MINERAL RESOURCES OF THE UNITED STATES for the calendar year 1907. In two volumes: Part 1, metallic products; Part 2, non-metallic products. Published by the U. S. Geological Survey.

El Noticiero has reached its fourth number, and continues the promise of usefulness given in the preceding issues. The copy before us contains an important article on the concession for a national bank of issue for the Republic of Honduras, granted to A. J. Moisant. Difficulties over the recent decision of the Court of Cartago lend peculiar interest to financial arrangements in Central America.

REPORT OF THE DIRECTOR OF THE MINT UPON THE PRODUCTION OF THE PRECIOUS METALS IN THE UNITED STATES. Issued by the Treasury Department, Washington, D. C.

THE INTERPRETATION OF TOPOGRAPHIC MAPS. By Rollin D. Salisbury and Wallace W. Atwood. Professional Paper No. 60 of the United States Geological Survey.

ECONOMIC GEOLOGY OF THE GEORGETOWN QUADRANGLE, COLORADO. By Sydney H. Ball. Professional Paper No. 63 of the United States Geological Survey.

Commercial Paragraphs.

THE BYRON JACKSON IRON WORKS, West Berkeley, Cal., has recently received an order for a number of 5 and 6 in. turbine pumps to be used on a sugar plantation near Honolulu. This order is a duplicate of one filled by the same company six months ago.

BETTLES, MATHEZ & CO., of Salt Lake City, have a metallurgical and chemical laboratory for custom assaying and making tests for the guidance of those who contemplate erecting ore reduction plants. The principal members of the firm are A. J. Bettles, manager of mills for the Newhouse interests, and Augusté Mathez, mining engineer. A. F. Bardwell, formerly of Aspen, Colorado, is manager.

THE NATIONAL WOOD PIPE CO., Los Angeles, has recently made the following sales: To the Southern Pacific railway, 6000 ft. of 6-in. machine banded redwood pipe for use at Santa Barbara; to the Ash Meadows Water Co., 20,000 ft. of 6-in. pipe for use at Rhyolite, Nevada; and to the Grand Canyon Electric Light & Power Co., 15,000 ft. of 4, 6, and 8-in. pipe for use at Williams, Arizona. The company has just opened a general sales office at 210 Wells Fargo Bdg., Portland, Oregon.

THE POWER & MINING MACHINERY CO. of Cudahy, Wis., reports the following sales of mining machinery: Through the International Mach. & Eng. Co., Mexico City: Cia. Minera de Tenamache, one 10-stamp mill with crushers and 5 by 18 ft. tube-mill; Cia. Minera la Victoria y Topada, one 10-stamp mill complete with 5 by 18 ft. tube-mill; Cia. Minera San Antonio, one 10-stamp mill with 5 by 14 ft. tube-mill. Through the San Francisco office: Harris Mining & Milling Co. of Nevada, 10-stamp mill equipment; Seoul Mining Co. of Korea, one 5 by 22 ft. tube-mill.

Catalogues Received.

THE BLAKE & KNOWLES STEAM PUMP WORKS, New York, are distributing four new Bulletins, No. BK 825, 826, 827, and 828, covering vertical triplex power pumps, deep well pumps, and ammonia pumps.

THE DU BOIS IRON WORKS, Du Bois, Pa., has just published its 1909 catalogue descriptive of Du Bois gas engines and producer gas plants. Anyone interested in this rapidly growing industry would do well to send for this catalogue.

THE KELLY FILTER PRESS CO., Salt Lake City, Utah, is distributing its 1909 catalogue which describes and illustrates in detail the Kelly filter press. It should be in the hands of anyone interested in filtration.

THE HARRISON-WALKER REFRACTORIES CO., Pittsburg, Pa., has just published a handsome catalogue bound in leather, with gilt edges. That fact in itself does not mean much, but when one realizes that the contents of the book are well worth the elaborate binding, then the reason becomes apparent. Every person interested in the use of fire brick or other refractory materials should have a copy. An interesting feature is 60 pages devoted to detail drawings of different furnaces, boiler settings, and the like. In addition to the complete dimensions of the various shaped brick, there is included a number of pages of useful information.

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EDITORIAL.

OUR London correspondent makes mention of the highly satisfactory report presented at the recent annual meeting of the Exploration Company. Many of our readers will share our pleasure in being informed of the successful operations of this pioneer among the houses of issue responsible for important mining enterprises. We note also, with interest, that Mr. R. T. Bayliss, the chairman, announced the formation of a new company financed by his associates with the purpose of carrying out a systematic scheme of exploration in Mexico. The undertaking is to have a capital of £250,000, and Mr. Robert M. Raymond, the present manager of the El Oro and the Mexico mines, at El Oro, is to be general manager. The enterprise will start under the best auspices and should prove both successful and useful.

IN his speech, as retiring president of the Chamber of Mines of the Transvaal, Mr. Lionel Phillips spoke most cheerfully concerning the local mining industry. Although local in a sense, the operations around Johannesburg are of world-wide importance. Since 1884 the Transvaal has produced £227,084,385 —pounds, not dollars. In 1908 the tonnage treated was increased by 2,670,000, and the dividends distributed by £1,659,700. Up to date the gold mines of the Transvaal have paid £55,041,587 in dividends. At the present time the earnings of the producing companies yield a return of 8.79 per cent on the market valuation of the shares. Working costs, in 1908, were reduced 2s. 9d. per ton, and thereby the ore reserves of the 67 productive mines have been increased by 5,400,000 tons, or 9 per cent on the previous estimate. These are large figures, but they are in keeping with a mining district that yields one third of the gold being produced in the world.

IT IS presumable that the production of zinc ore in Mexico for shipment to the United States would have increased under the stimulus of high prices for spelter, had such continued, and no one would have been concerned to thwart the Mexican producer while all went merrily at home; but when depression came, and one mine after another in the zinc regions of the Mississippi Valley was forced to close, the increase of 25 per cent in importations of ore from Mexico in one year challenges attention. The average zinc-content in the Missouri ores is about 60 per cent; in the Mexican it is 40. The Mexican ore costs the smelter about $16 per ton. As one ton of the American ore is equivalent in metallic content to one and a half of the imported ore, for equal amounts of recoverable spelter the cost of the Mexican would be $24, as opposed to a cost of production at the Missouri mines of nearly $38. It is proposed that in the interest of the zinc miner a tariff of 1½

cents per pound be imposed on the metal in the imported ore, which would enable the American to command a price of $42 per ton. That would allow him a profit of $4, which is reasonable. Certainly it is not reasonable to protect the smelting companies by a tariff on spelter, which sustains an industry that benefits comparatively few, while the mines which afford work to many are left without assistance. If the public be asked to tax itself for one or the other, it should answer by taxing itself for both or for neither.

PLATINUM at the present time comes mainly from the placer mines of the Iss and Tura rivers, tributaries of the Tiumen, on the eastern slope of the Urals. The mines are owned by a French syndicate, which thereby controls the platinum market, but the neighboring Russian proprietors, notably Shuvaloff, have contracted to sell their output at a fixed figure to the French syndicate. For purposes not understood the price of the metal has been lowered to $24 per ounce as against $39 not long ago; the reason being either that the consumption has not kept pace with the supply, which has been cornered, or that the producers are afraid of competition on the expiration of existing contracts in the Ural, as well as from Colombia.

COLLAPSE has overtaken the independent smelter at Ponderay in Idaho. Disaster was inevitable from the beginning. A small plant, dependent solely on smelting with a lead base, and having no means for treating matte, had no chance for survival. Complaints of discrimination by the railroads are freely made, but without having in hand specific allegations on this point, we may observe that the regulations approved by the Interstate Commerce Commission would of necessity operate against Ponderay. The Montana Mine Owners' Association would have done better to have erected a new plant at Helena or Tacoma. They might at least, in that event, have actually competed with, or, in other circumstances, have sold out to the 'enemy'. As it is, they have been paralyzed by a 'chill' that bespeaks poorer business judgment than metallurgical ability.

WHEN the brothers Cowles produced aluminum alloys direct from ores in the electric furnace at Lockport, New York, and the pure metal was made electrolytically by Charles S. Bradley, the arrival of the aluminum age was confidently announced. That was nearly twenty years ago. Today the revolutionary effect of introducing a great new factor into the metal industries of the world is on the verge of realization. The claims of inventive genius have been paid off, the utilization of aluminum on a grand scale having been delayed until the obligation was satisfied. With an unfettered opportunity this metal will draw the attention of metallurgists henceforward equally with iron and copper. An interesting article on some characteristics of aluminum will be found elsewhere in this issue. It should be pointed out that the alloys of aluminum offer a remarkable field, and will probably expand rather than reduce the consumption of copper.

A BILL is now before the Russian Duma to introduce into Russia a complete system of workmen's insurance. The plan as proposed has been drafted by the Ministry of Commerce and Industry and in general follows the German system. It will probably soon become a law and will be a boon to foreigners operating mines or other industrial enterprises in Russia, removing vexatious liabilities and at the same time raising the efficiency of labor. Special insurance companies are to be formed under the joint control of the Ministry of Commerce and Industry, the local administration, and representatives of the mine or factory owners. Funds will come from premiums paid by workmen, taxes on employers, fines, and voluntary contributions. In case of accident totally disabling a workman, he receives an amount equivalent to two-thirds of his regular wages until able to resume work or given a pension for permanent disability. If he is able to return to work, but with decreased earning power, a proportionate allowance is made to him. In case of death provision is made for his widow and children; benefits are paid in case of illness as well as accident; women and children workers, as well as men, participate in the insurance. The insurance companies will also give attention to the improvement of workmen's conditions, sanitation, hospitals, safety-devices, and so forth. What a lot of damage suits, expensive litigation, and needless suffering this enlightened law would save if adopted in the United States!

Deep Metal Mining.

As our readers are aware, the deepest gold mine is the Victoria Quartz at Bendigo, in Australia; this mine has a vertical shaft that has been sunk to 4300 feet and a winze that is 225 feet deeper, making the total depth 4525 feet. In these deepest workings a saddle-reef has been cut, but it does not carry payore, in fact, the Victoria Quartz Company has asked the Government of Victoria for a grant of £10,000, and the Minister of Mines has replied that he would provide the money if the company would agree to sink another 1000 feet. In California, the main shaft of the North Star mine at Grass Valley is down 5400 feet on the vein, which has a dip of 28°, so that the maximum vertical depth is only 2086 feet. At the bottom the vein is larger and shows more gouge than on the upper levels; in consequence, more waste is mixed with the ore, reducing the average yield to $12 per ton for a width of 6 feet, as against the 18 inches of $18 ore that was extracted from the upper workings. No defined ore-shoots exist, the mine is becoming less wet, but the prospects of profitable exploitation continue undiminished with increase of depth. The neighboring Empire mine has an incline shaft that is down 3500 feet on the vein but only 1570 feet vertically below the surface. This mine is said to be in a highly productive condition. The Kennedy, on the Mother Lode, in Amador county, is one of the famous mines of California. The maximum depth attained is 3254 feet, with stoping in progress from 2000 to 3000 feet, and an excellent showing at the bottom. The shaft is now being sunk. Speaking in a general way, on the Mother Lode the rich ore found

at surface reached to about 300 feet; between that depth and 700 feet there was, in many cases, an impoverishment, which was succeeded at 1000 feet with another zone of profitable ore, extending to 1700 feet; then the lode became poor again until about 2500 feet, at which depth a few mines obtained another lease of life. On the Comstock the deepest mining now in progress is on the 2300-ft. level of the Ophir, which is 2552 feet below the Gould & Curry outcrop. It will be remembered that the greatest depth attained on the Comstock was in a winze in the Mexican mine, which, before the flooding of the workings in 1884, reached down to 3308 feet, or 3554 feet below the Gould & Curry outcrop. On the Rand the shaft of the Cinderella Deep is down to 4200 feet and that of the Jupiter to 4230 feet. Before long Johannesburg will have many deep mines. In Brazil the Morro Velho shaft of the St. John del Rey has reached a depth of 4264 feet. But the deepest metal mines are still in the Lake Superior copper region. There the Red Jacket shaft of the Calumet & Hecla mine is 4920 feet vertical; while the Tamarack has two shafts over 5000 feet deep, namely, No. 5, which is 5180 feet, and No. 3, which is 5230 feet vertical. These Tamarack shafts were sunk to extract ore from the copper lode first exploited in the Calumet & Hecla, and they cut a lode having a dip of 38° at a vertical depth of 4660 feet. By attaining a depth of one mile underground and by showing with what ease operations are conducted at that great depth, these Lake Superior mines have demonstrated that man is likely to be able to penetrate at least as profoundly into the earth as the ore persists.

Protection of Investors.

We have given our space freely to the discussion of the question how best to protect mining investors, believing that it would tend to the formation of a healthy public opinion on the subject. In this, as in many other matters of public interest, there is more danger in drifting than in perverse steering. Even if no panacea for the ills of the speculating portion of the community may have been discovered, it is well to note that no one has dared to express opposition to the effort to cure the ills that afflict the business of mining. No one, for instance, ventures to say in print that shareholders ought to be kept in the dark as to the doings at the mine, or that the directors are entitled to pervert their position as trustees into advantageous gambling, or that the manager is warranted in doctoring his reports according to the needs of his stock speculations. Men may do these things, but we are at least so far on the road to reform that none dare advocate such doings openly. On the contrary, public opinion is becoming clarified; that is one of the functions of serious journalism; that also is one of the functions of professional associations such as the Mining and Metallurgical Society of America. Laws are useless without the momentum of public opinion; that is why so many new statutes are still-born and so many old enactments have become dead letters. In America, particularly, the protection of mine investors is a question that needs ventilating because the misuse of money in fraudulent or foolish schemes is one of the heavy taxes paid by the mining industry. England has the Companies Acts to protect the investor, but better than any Act of Parliament is the public opinion gradually developed in London by force of example and by compulsion of criticism. Even an English company is compelled by law only to furnish a balance sheet, and it is obvious that this constitutes a small part of the information required by anyone wishing to understand the condition of a company's affairs. English mining companies do more; they have learned to treat their shareholders fairly and to give information frankly. Why? Because, in the first place, those in control of meritorious mining enterprises desired to win the confidence of the conservative type of investor; they had something to show and were willing to show it, thus compelling others by force of example to follow their lead in the hope of winning a similar reputation for honorable dealing. As soon as it became the characteristic of successful mining companies to give full and prompt information to their shareholders, it also became advisable for doubtful enterprises to imitate such practices. It became fashionable; which means that the public expected it. When the Exploration Company, John Taylor & Sons, Bewick, Moreing & Company, the Consolidated Mines Selection Company, and similar houses of issue, showed some respect for the intelligence and property rights of shareholders, it became incumbent upon the Whitaker Wrights, the Hooleys, and the Bottomleys, to go through the motions, at least, of giving information, in order to avoid public censure. Thus an excellent custom was created. And at a time, eight or nine years ago, when the custom suffered from lax observance, a group of mining engineers in London forced the hands of the company-promoters and stock-jobbers by furnishing criteria for the valuation of mines and explaining the methods of appraisal. That again put the company-managers on their mettle and led to the publication of real information, so that today the minority shareholder is fairly well protected. If he consider himself ill treated, he may attend the annual meeting, and raise a rumpus. If properly done, he will win support; if improperly, he will waste time. This feature of company-management has humorous aspects, and brings the proceedings occasionally to the verge of burlesque. Directors find it well to permit recalcitrant shareholders plenty of chance to air their grievances, recognizing that nothing will alienate support so readily as even an appearance of lack of fair play. In consequence, lawyers and others seeking notoriety will occasionally make themselves a nuisance; yet on the whole this publicity is an excellent safety-valve for discontent, and an admirable corrective of directorial superciliousness. We should have more of it in America; in England a director is made to feel, by law and by public opinion, that he is a trustee, not a privileged insider with first access to information and a prior chance to buy and sell stock advantageously. A sense of honor curbing selfishness would improve the management of mining companies.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

FRANCIS L. BOSQUI is at New York.

JAMES A. GILMOUR is at Leon, Nicaragua.

C. W. GEDDES is at Calabacillas, Chihuahua.

GEORGE E. FARISH is here from Mexico City.

FRED L. MORRIS has returned from New York.

HOWARD D. SMITH was at Oroville during the week.

EDWARD SIMPSON is returning from Tacoma to Dawson.

R. R. MOORE, of Garfield, Utah, is temporarily in Mexico.

W. H. STAVER, of Freeport, Illinois, is now at Hemet, California.

JAMES W. ABBOTT of Pioche, Nevada, was at Salt Lake recently.

CHARLES T. MIXER has returned from Sinaloa, Mexico, to Salt Lake City.

FREDERICK G. FARISH, of Denver, was in San Francisco during the week.

GEORGE WHEELOCK, of New York, is examining mines in Nevada and Idaho.

O. B. PERRY was at Oroville this week, and is now on his way back to New York.

EMERSON GEE is in Oaxaca, Mexico, but will return to Los Angeles early in April.

OSCAR S. MARKS, lately at Winnemucca, Nevada, is temporarily in San Francisco.

R. A. KINZIE has returned to San Francisco from a visit to Goldfield and Ely, Nevada.

BEN S. REVETT, of Breckenridge, Colorado, was in San Francisco during the past week.

H. C. SANDIFER, who is operating at Seven Troughs, Nevada, was in San Francisco lately.

ALTON L. DICKERMAN has returned to Boston from Northern Ontario and will proceed shortly to Mexico.

CURTIS L. KNIGHT, former superintendent of the Valcalde mine, Silver Peak, Nevada, is at Salt Lake.

VICTOR C. HEIKES, statistician of the U. S. Geological Survey, stationed at Salt Lake City, was at Butte recently.

J. M. NICOL has returned from a visit to Trinity county.

F. R. CARPENTER and ARTHUR HOWE CARPENTER, of Denver, were recently in Nevada and Utah.

FRANK ELMORE, having put into successful operation the 12-unit vacuum concentration plant at the Sulitjelma copper mine in Norway, has left for Trondhjem.

CHARLES W. WRIGHT, of the U. S. Geological Survey, has returned to Washington from Sardinia, Italy, where he made an examination of the Pertusola lead and zinc mines.

The Pacific Coast section of the Mining and Metallurgical Society of America met in regular session on March 13 at the Key Route Inn, Oakland. The following members were present: S. B. Christy, A. C. Lawson, F. W. Bradley, R. A. Kinzie, George W. Starr, Charles Butters, C. C. Derby, E. A. Hersam, T. A. Rickard, M. L. Requa, and W. H. Shockley. Also the following guests: Ross E. Browne, Charles Hoffmann, George Hoffmann, E. H. Garthwaite, and E. B. Durham. The next meeting will be late in April.

Obituary.

HENRY BAUSCH, who died at Atlanta, Georgia, recently, will be gratefully remembered by microscopists for his many original contributions to the advancement of that branch of science. He was a good example of the man who brings high technical qualifications into alliance with commercial enterprise. He was vice-president of the Bausch & Lomb Optical Co., of Rochester, N. Y., and was fifty years of age at the time of his death.

Latest Market Reports.

LOCAL METAL PRICES—March 18.

Antimony	12@16c	Quicksilver (flask)	44@46
Electrolytic Copper	15¼@16½	Spelter	6¼@7c
Pig Lead	4.45@5.40c	Tin	32@33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 11. £. s. d.	Mar. 18. £. s. d.
Camp Bird	0 15 9	0 15 9
El Oro	1 3 9	1 3 9
Esperanza	2 16 3	2 11 0
Dolores	1 10 0	1 10 0
Oroville Dredging	0 10 6	0 10 6
Mexico Mines	4 15 0	4 12 6
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver per oz.
Mar. 12	12.31	3.98	4.76	50½
" 13	12.25	3.98	4.76	50¾
" 14	Sunday.	No market.		
" 15	12.25	3.98	4.76	50¾
" 16	12.18	3.98	4.76	50¾
" 17	12.12	3.98	4.76	50½
" 18	12.12	3.98	4.76	50½

MINING QUOTATIONS—NEW YORK.

	Closing prices. Mar. 11.	Mar. 18.
Amalgamated Copper	68⅜	68½
American Smelting & Refining Co	83	84¼
Boston Copper	11	11¼
Butte Coalition	23	22⅝
Cumberland Ely	7¾	7⅝
Dolores	6	6¼
El Rayo	2⅝	2⅞
Giroux	8¼	8¼
Greene-Cananea	9⅜	9¼
Indiana Sonora	3¾	3¾
La Rose	6½	6⅝
Miami Copper	13¼	13¼
Nevada Consolidated	17⅝	17⅝
Newhouse	3⅞	3½
Nipissing	10⅞	10⅝
Ohio Copper	7⅞	8¾
Tennessee Copper	40	41¼
Utah Copper	41	41½
Yukon	4⅜	4¼

(By courtesy of Trippe, Thompson & Co., 25 Broad St., New York.)

COPPER SHARES—BOSTON.

	Closing prices. March 18.		Closing prices. March 18.
Adventure	7½	Mass	4⅜
Ahmeek	140	Mohawk	61
Allouez	38	North Butte	67½
Arcadian	4¾	Old Dominion	48½
Atlantic	14	Osceola	125
Calumet & Arizona	99⅞	Parrot	31⅛
Calumet & Hecla	615	Santa Fe	2⅛
Centennial	29	Shannon	14
Copper Range	74	Superior & Pittsburg	13
Daly-West	10¼	Tamarack	77
First National	6⅝	Trinity	13⅛
Franklin	14	United Copper Con	12¼
Granby	90	Utah Con	39¾
Greene-Cananea, ctf	9⅜	Victoria	4
Isle Royale	25¾	Winona	5½
Lake	—	Wolverine	138

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, March 18.

Atlanta	$ 11	Midway	22
Belmont	85	Montana Tonopah	65
Booth	18	Nevada Hills	1.30
Columbia Mtn	9	Ophir	98
Combination Fraction	1.00	Pittsburg Silver Peak	69
Daisy	51	Rawhide Coalition	66
Fairview Eagle	10	Rawhide Queen	48
Florence	3.10	Round Mountain	80
Goldfield Con	7.85	Sandstorm	10
Gold Kewenas	10	Silver Pick	7
Great Bend	17	St. Ives	14
Jim Butler	19	Tonopah Extension	65
Jumbo Extension	11	Tonopah of Nevada	6.80
MacNamara	33	Tramp Con	11
Mayflower	16	West End	33

General Mining News.

ARIZONA.

The copper production in Arizona last month, as reported by interests which yield nearly 90% of the output, was 26,500,000 lb. The Copper Queen led with 9,150,000, the Calumet & Arizona and Superior & Pittsburg made 4,000,000, and Senator Clark's United Verde mines produced almost 3,000,000 lb. Arizona in 1908 produced almost 295,000,000 lb. of copper. Twenty-five years ago Arizona was almost at the bottom of the copper-producing camps of the West. Arizona's copper production has more than doubled in 10 years. In 1908 Arizona produced more copper than any other State, making 33,000,000 lb. more than its nearest rival, the State of Montana.

GILA COUNTY.

Work on the extension of the Gila Valley, Globe & Northern railway to Miami has been begun and will be completed as rapidly as possible. This will give a great stimulus to the activity of the mining district of Miami flat.

CALIFORNIA.

NEVADA COUNTY.

E. H. Wilson has secured a bond on the Oustomah mine, and has already taken charge of the property. A new wire cable has been ordered and the shaft is to be sunk deeper, while the 10-stamp mill will be started presently.——Mark B. Kerr, of the Pittsburg-Gold Flat-Potosi mines, has completed a contract with the Bay Counties Power Co. to furnish electric power for the mines of which he is manager. In the past the Pittsburg was operated by water-power. The machinery at the mine is being overhauled and placed in good condition for work. Men are making headway in cleaning out and repairing the old drain adit.

SAN BERNARDINO COUNTY.

The Montana lease, in the Big Chief tunnel, has struck a bonanza, from the richest portion of which assays up to $2000 per ton have been obtained. The high-grade streak, varying in thickness from 3 to 8 in., is one of the richest deposits discovered in the Hart district. In the same drift, about three weeks ago, Charles Hammer found another bunch of rich ore, but in a few feet it pinched out, owing to a fault occurring at that point. Foster & McCluskey, the owners of the Jumbo, have been finding ore on the 100-ft. level of their mine which surpasses anything they had previously opened. This vein is about 4 ft. wide and shows an abundance of free gold. The east cross-cut has exposed the Jumbo vein as being 25 ft. wide, all of which is of sufficient grade for milling purposes. William L. Foster has issued his report on the Big Chief and Long Shot claims at Hart. In the east side adit about 300 ft. of work have been done, while in that on the west side more than 700 ft. of progress have been made. Three veins have thus far been cut, all of which are of milling grade, with some streaks of quite rich ore. A special meeting of the stockholders will be held in Phoenix, Arizona, on March 30, to effect the merging of the Hart Consolidated and Big Chief estates. As soon as this is accomplished active work on the Consolidated will be begun, and a 40-hp. hoist installed to sink a shaft.——Twelve miles west of Hart a discovery of uranium ore has been made by W. J. Murphy; it occurs in calcium phosphate, and an analysis by W. B. Meade, of Barnwell, shows 11% of uranium oxide. The pure oxide is quoted at $3.50 per pound.

TRINITY COUNTY.

(Special Correspondence).—The Union Hill mines near Weaverville are running successfully and doing good work, using three Marysville giants. C. G. Goodyear is manager and H. E. Crowell secretary.——The Trinity Gold Milling Co., with headquarters at Kansas City, is operating the old Baudrey mines near Weaverville. They have about 15 miles of ditch line. An open flume built of steel, by the Risdon Iron Works, leads down to their pipe-line. This flume is set at a grade of 30°, is 1000 ft. long, 3 ft. wide at the top and 18 in. at the bottom, and 4 ft. deep. It discharges into a large penstock from which the pipe-line starts. A steel flume was installed, as it was found that on a steep grade a wooden flume wore out too rapidly. The pipe-line is over 2000 ft. long and is equipped with four branches at the lower end, two of which go to the mine, one to the small electric lighting and hoisting equipment, and the other to the sawmill. Operations at the mine are carried on by means of three large giants, No. 5, 6, and 8 respectively. The banks are about 100 ft. high and the sluices are set at a grade of about 8 inches in 12 ft. I understand that one very good clean-up has been made and that prospects look bright for a successful run this season. W. V. Whipple is general manager.——The Trinity River Mining Co. has practically completed its tunnel through the big bend and is now contemplating the installation of a power-plant to develop pressure water by pumping, for the purpose of operating in the river channel, which will be exposed as soon as the water has been turned through the tunnel. John M. Nicol, hydraulic engineer of the Joshua Hendy Iron Works, has recently been on the property for several days, making plans and estimates for the complete equipment. The project seems feasible, and prospects are good for an early installation.——The Boomer mine near Denny, on the New river, has been pushing development work all through the winter and they expect at an early date to cut the vein in the new cross-cut which is being driven. R. A. Skinner is lessee and manager.



The Sierras as Seen in San Bernardino County.

TUOLUMNE COUNTY.

J. L. Tonkin and M. E. Sanford have brought suit against W. H. Remington and J. D. Barber to recover possession of the Patricia, Marie, and Sanford mining claims, in Wet gulch, near Columbia. In addition to the payment of the purchase price of $8000, the defendants were to sink a shaft at a designated point in the Patricia 100 ft. deep, unwater the old shaft, construct a hoist, and to install a small mill. The plaintiffs claim that the machinery placed on the mines was of poor quality and that the shafts and drain tunnel, by reason of poor work and neglect, caved in, causing damage to the amount of $3500.

COLORADO.

CHAFFEE COUNTY.

Fred Kuenzel hopes to blow in four of his new process furnaces at Buena Vista early in May, each having a capacity of 50 tons per day. The steam and electric plants are being installed, and a spur track from the D. & R. G.

railroad has been laid to connect with the ore-bins of the smelter.

CLEAR CREEK COUNTY.

(Special Correspondence).—Records have been filed with the county clerk whereby the Silver Creek Mining Co. and Kate Bullis, deed to the Alice Development Co. the Alice group of mines situated in the Alice and Yankee districts. The consideration is said to have been $300,000, a cash payment of $88,000 having already been made. The territory embraces over 1100 acres of mineral-bearing ground. About a year ago A. H. Roller and W. L. Shaffer, both of Idaho Springs, secured an option on the Alice mine, and tested for the best method to extract the gold. A 5-stamp mill was erected, equipped with an electro-chemical process, and demonstration was made that the entire vein matter could be handled at a profit. It is now intended to construct a reduction plant with a capacity of 150 tons per day.——The Fall River Power & Light Co., with a capitalization of $100,000, has been incorporated to construct reservoirs for the storage of water on upper Fall river, where electricity is to be generated to be sold throughout the lower end of the county. A big group of claims is controlled, and work is to be put under way at an early date. A. H. Ristedt, of Idaho Springs, is the moving spirit in the enterprise.——Development is progressing in the Seven-Thirty and Dives-Pelican mines, most of which is being done through the Burleigh adit workings. The ore now being broken in the stopes of the Phillips vein is sent to the Pelican mill for concentration. This mill is running one shift only, but next week a night shift will also be put to work. The aerial tramways running to the Pelican dump are doing excellent work, about 200 tons of ore being delivered daily. The bins have a capacity of 1500 tons, and now that they are practically full, a heavy tonnage of concentrates will be marketed from this time on.

Georgetown, March 13.

LAKE COUNTY.

Dudley M. Gray, manager of the Dinero mine, is making good progress in connecting the adit of the mine with the old shaft, which is now full of water. Three raises are being put up from the adit level, and are drawing much of the water-flow from above, besides developing abundant ore which assays about 75 oz. silver per ton. When within a reasonable distance of the Dinero shaft, a drill-hole will be run from one of the raises to obviate the danger of a rush of water.——The Ontario tunnel near Twin Lakes is producing good ore from a 3-ft. vein which was discovered last fall, and the owners are now contemplating the erection of a mill.

OURAY COUNTY.

Among the transfers recently recorded in Ouray is one by Thomas F. Walsh to John W. Benson of an eighth interest in the Goodluck, Goodluck Extension, Tarmagan, and Groundhog, and a 92% interest in the Pocahontas lode mining claims, all in Sneffels district and situated near the Camp Bird mine.

TELLER COUNTY.

John H. Nicholls has been appointed superintendent of the El Paso Consolidated Gold Mining Co. at Cripple Creek. He has formerly been general manager for the Prince Albert Mining Co. in the same district.——The Portland Gold Mining Co. made an exceptionally good showing in February. The properties are now operating in a way that indicates the certainty that the $2,000,000 mark for annual yield will be attained this current year. The total production last year was 94,311 tons, of the gross value of $1,835,000, the average value per ton being $19.45.——Frank O. Ganson has opened up a flat vein in the Mary McKinney mine which is now exposed for a length of 18 ft., and is from 3 to 6 ft. thick. Part of this is shipping ore worth 2 oz. gold per ton, and the remainder when sorted will be a good grade of milling ore.

IDAHO.

BONNER COUNTY.

H. D. McLeod, of Cleveland, is at Sandpoint on the shores of Lake Pend d'Oreille, superintending the construction of the Midas galena mill from his own designs.——John Mocine, secretary and treasurer of the Idaho Smelting & Refiining Co., has been appointed receiver of the Panhandle smelter at Ponderay, owned by the Greenough Bros. and the Montana Mine-owners' Association. Shippers have been advised to stop consignments of ore, and it is given out by Thomas L. Greenough, general director of the company, that 1000 tons of ore on the ground will be treated under the management of the receiver. The Idaho Smelting & Refining Co. was organized six months ago to take over the holdings of the old Panhandle Smelting Co. and assumed its indebtedness. This now amounts to about $200,000.

CUSTER COUNTY.

The Golden Sunbeam Mining Co., operating on Jordan creek, 4 miles from Custer, has free-milling gold ore in a vein that strikes through rhyolite. Ore averaging $25 per ton is being run through a crusher and a Monadnock mill fitted with amalgamating plates. It is reported that a recovery of $1600 in gold was made in 10 days in February. C. E. Gable is in charge.

OWYHEE COUNTY.

The Overlook Mining & Development Co., of which J. W. McCaw is president, has acquired two full quartz claims in the gold-bearing region 70 miles south of Boise, to develop the vein, said to be 20 ft. wide. Neil Campbell, of Walla Walla, is manager. The company has owned three claims on the lode, two carrying timber, and a mill-site since 1907, and it is intended to erect a 15-stamp mill there this coming summer.

SHOSHONE COUNTY.

George A. Cunningham, general manager of the Empire Mining & Development Co., has entered into a contract with Felix LeMarinel and D. C. Nicholson to run a cross-cut 1000 ft. long in the mine on Revenue gulch, two miles north of Wallace. The cross-cut is expected to strike the vein when 800 ft. of advance have been made, at a depth of 280 ft. The vein is on what is known as the Osborn Fault, as defined by the United States Geological Survey.

MICHIGAN.

The Superior is resuming rock shipments to the Atlantic mill. The south drift on the seventh level shows a remarkable richness. This drift is largely responsible for the high mineral returns from the past mill runs, which averaged 37 lb. copper per ton during the month of February.——The Michigan is sinking shaft A below the 16th level. It is now over 2000 ft. from the surface. From the 12th to the 15th level the ground shows some slight enrichment. The 16th level shows the lode narrow, but with greater enrichment. A large tonnage is blocked out in the old Minnesota branch, which may soon be stoped.——Victoria's drift west on the 22nd level is getting into exceptionally good copper ground, about 400 ft. from the shaft. The company is operating a single shift, owing to the scarcity of water. There is small likelihood of the force being increased to any extent for another 60 days.

MONTANA.

SILVER BOW COUNTY.

H. V. Winchell, consulting geologist of the Amalgamated Copper Co., and former chief geologist of the Great Northern railway, has made an examination of the East Butte mines and declares their condition excellent and the prospects promising.——The Anaconda Co. is still engaged in re-timbering the Belmont shaft from the 1000-ft. level to the surface, and work will not be completed for several months.——It is understood that new capital has been interested in the properties of the Amazon-Butte Co., which owns a valuable group of claims south of the Pittsburg & Montana properties. It is expected that operations will be resumed within the next six weeks. The work was suspended more than a year ago, because of the financial depression. The Amazon-Butte Co. owns six claims, with a shaft 400 ft. deep.——On the Badger State the Amalga-

mated Copper Co. is enlarging the shaft from 2-compartment to 4-compartment, and the shaft is now down nearly 1200 ft. It is understood that it is the intention of the company to eventually use the Badger State on the north, and the Belmont on the south, as the two principal working shafts for all of the mines controlled by it. This will minimize the cost of hoisting and reduce the cost of mining materially.

NEVADA.

ESMERALDA COUNTY.

J. H. Mackenzie, of the Goldfield Consolidated, is giving up the management of that property, now that he has accomplished the construction of the new mill and has organized the development of the mines' orebodies. He will still retain general direction of the undertaking, leaving the execution thereof to his staff. Mackenzie is now turning his attention to the oil fields at Coalinga, in which he is interested together with Messrs. Wingfield, Nixon, Bradley, and Requa.——The new process of gold extraction from the concentrates by an acid process devised by J. W. Hutchinson, superintendent of the Consolidated mill, is doing good work. It is recovering a high proportion of the total content, and is also saving an immense amount of freight and smelting expense to the company.——A test run of about 100 tons of the ore now exposed at the Valcalda mine, near Blair, controlled by Samuel Newhouse, will soon be made with a view of determining the efficiency of the plant; and if results are satisfactory the capacity will be increased to 150 tons at least per day.

HUMBOLDT COUNTY.

The Imlay Mining Co. has made arrangements for the construction of its mill at Imlay. The contract for both equipment and buildings has been given to the General Engineering Co. of Salt Lake.

LINCOLN COUNTY.

Some fine specimens of vanadate of lead taken from the property of the Noble Five Co., four miles east of Morgantown, are being displayed in Crescent.——A. J. Peak was the sole owner of the Silver Sphinx at Nob Hill prior to the present incorporation.——It is now called the Oxnard-Eldorado Mining Co., with a called-up capital of $30,000. Present arrangements for development entail sinking the shaft 500 ft., installing a gasoline hoist, and erecting new mine buildings.——It is said by officials of the Nevada Utah Co. that a large body of high-grade ore has been uncovered in the May Day mine, and has been proved down to the 800-ft. level.

NYE COUNTY.

The Tonopah Co. sent 3200 tons, the Belmont Co. 850, the Montana-Tonopah 781, the Midway 100, MacNamara 350, West End 135, and Jim Butler 200 tons to the mills, making a total shipment for the week of 5616 tons, with an estimated value of $140,000.——The most notable development of the week at Pioneer has been a strike of rich ore in the 300-ft. level of the Mayflower mine. The new mill is handling ore of good quality. The ore is delivered from the mine to a Blake crusher set at 1½ in. The broken ore is passed to the 5 stamps crushing to 40 mesh, and thence to the amalgamating plates. The stamps weigh 1000 lb., drop 100 times per minute, and were furnished by the Joshua Hendy company of San Francisco. The mill has a capacity of from 12 to 15 tons per day. It is estimated that sufficient ore is blocked out to keep the plant running for six months.——The Taylor Bullfrog Mines Co. is arranging to resume work at its properties in Gold gulch. A 10-hp. engine will be installed.

(Special Correspondence).—The Dronham lease on the Balloon Hill has opened up a 4-ft. body of good grade ore. The shaft is being sunk to the 150-ft. level.——The Royal Mines Co. has resumed work on its lease on the Royal-Tiger. The incline shaft will be sunk from the 440 to the 500-ft. level. John E. Pelton is general manager.——The Rawhide Mountain Leasing Co. has relinquished the Big Four lease on the Rawhide Consolidated. Lack of funds is the reason given.——The Weiss mill is running through 50 tons of $15 ore from the Mint lease. The Mint management has leased the Murray mill and in the future will treat most of its low-grade ore at this plant. The mill has a capacity of 30 tons per day.——The Gold Reef Co. has taken over the lease on the Grey Eagle Fraction and is pushing work on the tunnel. The life of the lease is three years.——The Mother Lode lease has uncovered a 4-ft. vein on the estate of the Rawhide Queen Co. The vein has been developed for about 80 ft.——The shaft at the Royal Regent is down 50 ft. and it is intended to install a hoist in the near future and sink the shaft deeper. The vein is apparently a continuation of the orebody opened up in the Walters' Boys lease on the Czar claim.——The Bradshaw lease is arranging to install a 25-hp. hoisting plant at its recently completed vertical shaft. This lease is making steady shipments of good ore.——San Francisco and Rawhide capitalists are promoting a new bank and plan to erect a large custom mill. The plans of the promoters are said to be practically completed.——The camp is very quiet, although considerable work is going on, most of this being performed by lessees. Between 60 and 70 hoists are in commission.

Rawhide, March 10.

WASHOE COUNTY.

An immense deposit of iron ore has been discovered in the Fort Sage range of mountains near the California-Nevada line, within about four miles of the Western Pacific railroad. Analyses of the ore show 68% iron, only 0.007% phosphorus and no sulphur. The deposit is in the shape of a dike 400 to 1000 ft. wide, and has been followed for a distance of five miles. With electric smelting of iron ores a demonstrated success, western Nevada may some day become an iron manufacturing district. The principal owners of the deposit are W. H. Paul, of Salt Lake City, John S. Phillips, and Orlando McNabb, Nevada mining men.

WHITE PINE COUNTY.

The Scott Mines Co., a Salt Lake corporation, is reported to be negotiating for the purchase of 363 acres of land, containing extensive deposits of iron ore, in the Ely district, owned by the Ely-Calumet Co., controlled by Tex Rickard, Al D. Meyers, and John K. Turner. It is said that the deal involves about $500,000.

OREGON.

JACKSON COUNTY.

Abe Lamb, manager of the Ashland Peak mine, situated three miles south of Ashland, states that the adit, which is being driven on the vein by machine drills, is now in 250 ft. The vein is 7 to 9 ft. wide, stands vertical, and is well-defined between clean-cut walls. After the orebodies are well opened up a quartz mill will be installed at the mine.

UTAH.

JUAB COUNTY.

(Special Correspondence).—The shaft of the Gemini mine, at Eureka, has reached a depth of 1900 ft., the last 200 ft. being below water-level and in sulphide ore. The extensive workings above the 1700-ft. level were entirely in oxidized and carbonate ores, the silver found there being chloride, bromide, and iodide, associated with cerussite; while below water-level the silver occurs as stephanite, argentite, and combined with galena and gray copper, with some ruby silver. There is also, in these sulphide ores, an improvement in the percentage of copper over that found in oxidized ores. The sulphide ore is of excellent grade and the vein structure below water-level is the same as that above it. The Gemini is in the limestone and, while there are deeper mines in this formation in the Tintic district, it is the first to reach sulphide ore.

SALT LAKE COUNTY.

Connections have been made between the main shaft and the raise from the Mascotte tunnel, at the mine of the Ohio Copper Co. in Bingham canyon. The two workings came

together exactly, and has caused genuine satisfaction to Colin McIntosh, the manager. The complication and length of the survey was very considerable, and McIntosh says that much credit is due to Frank Goodman and John Berg, the two surveyors who laid out the work.

George and Jerry Peterson, brothers, who were entombed in St. Patrick's mine in Hughes canyon, at the lower end of Big Cottonwood, as a result of a cave-in of a tunnel of the mine, were rescued after fifty hours of heroic effort upon the part of the rescuers. The men were imprisoned about 300 feet from the mouth of the tunnel, and were threatened with death from three sides—starvation, suffocation, and drowning. Samuel Newhouse and several of the district managers were on the scene superintending the rescue of the men, who are now reported to be well on the way to recovery.

TOOELE COUNTY.

The mill of the Boston Sunshine at Mercur is nearly complete, and will be ready for its daily capacity of 200 tons per day within a couple of weeks. The process has been so designed as to obviate the necessity for roasting.

SOUTH DAKOTA.

LAWRENCE COUNTY.

(Special Correspondence).—A number of mines and mills will resume work this spring, some of which have lain idle for two or more years. The most important of these is the Branch Mint, with 120 stamps and a cyanide plant. It is situated at Galena, 12 miles east of Deadwood. James Harden is the manager.——A new mill will be started next month 5 miles east of Deadwood. This is the Golden Crest, with L. A. McCandless as superintendent.——The Lucky Strike Mining Co. is another in the same district that announces its readiness to start milling operations in a short time.——Among others making the same announcements are the Tinton tine mines, the Girtie tin mines, the Christopher Columbus, and the Echo Mining Company.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence.)—Strikes of ore are reported from the Jennie mine, in the northern part of the county, and also from the Summit Mining Co.——At Republic the lessees of the Insurgent mine have prepared a carload for shipment, that assays about $25 per ton.——The San Poil Republic Smelting Co. has been incorporated by R. W. Howard, W. B. Parker, R. J. Leonard, and others, of Spokane, Wash. It is reported that preparation for the installation of a smelter will begin about April 1. It is possible that a long-talked-of scheme to draw iron sulphide ore from Belcher district, 12 miles northeast of Republic, to flux with the Republic dry ores, may be carried into effect. The final articles of incorporation have not yet been filed.

Republic, March 13.

SPOKANE COUNTY.

Announcement is made that a tungsten refinery to cost $25,000 will be erected in Spokane this year to treat the ores from the tungsten mines near Deer Park, Washington, and Murray, Idaho. The only tungsten refinery now at work in the United States is at Boulder, Colorado. There are four cars of tungsten ore on the dump at the Deer Park mine ready for shipment, and it is given out that this ore is worth $800 per ton.

STEVENS COUNTY.

Alexander Sharp, manager of the First Thought Gold Mines, Ltd., is planning to build a cyanide mill on a site selected on the east side of the Kettle river, and considers the Park's process to be the most suitable for the treatment of the ore. He has reported that the ore can be treated on the spot for $1.25 to $1.50 per ton. No ore has been shipped by the company assaying less than $20 per ton, and a big tonnage assaying between $5 and $20 has been piled up at the mine awaiting treatment. A new cable has been ordered to replace the old one in commission between the mine and the mill.——A gasoline hoist and full equipment have been purchased for the Copper Butte mine.——Capt. L. Beecher has been organizing a company in Washington to acquire a number of mining claims in the Orient district and operate them under the same management.

CANADA.

BRITISH COLUMBIA.

A. J. McMillan, managing director, and W. A. Carlyle, consulting engineer of the LeRoi mine at Rossland, which closed a few days ago because of the lack of ore, are going to London, to confer with the directors as to future plans. The exploration work in the lower levels have not proved the extension of rich orebodies found toward the end of last year. As it is not economical to ship ore and carry on exploration work upon a small scale, it has been decided to suspend operations until arrangements can be made for carrying out development work in a more comprehensive way.——A 40-ft vein of good ore has been found on the ninth level of the War Eagle, and demonstrated to be over 400 ft. long. Assays give results between $20 and $100 per ton.——Strikes are also reported on the eleventh and twelfth levels of the Centre Star mine. Tnis mine continues to produce about 3000 tons per week, and made a clear profit of $30,000 during the month of February.

Work has been resumed by the Kootenay Development Syndicate on the Silver King mine near Nelson. Twenty-six men are employed at present and it is announced that the force will be increased this spring. Four machine-drills and a compressor are in operation. The mine was discovered by the Hall brothers in 1888, and was extensively developed by English capital. It was closed in 1902 and with the exception of some of the upper levels has not been worked until the present time. The Development Syndicate secured a lease on the property last summer, and preparations for the re-opening of the mine have progressed so well that now the eight upper levels are in shape to produce its copper and silver ores.



Cobalt in Winter.

ONTARIO.

The shipments of a recent week at Cobalt amounted to 528 tons, of which La Rose, Nipissing, and the Crown Reserve each contributed over 100 tons. The others making up the total were the Right of Way, Trethewey, City of Cobalt, and Cobalt Central. The Kerr Lake Co. has found some good ore at a depth of 150 ft., in a vein 7 in. wide that extends out under the waters of the lake. The Temiskaming and Crown Reserve companies have both declared 6% quarterly dividends, and the latter has added an extra of 9%. Silver was first produced from this camp five years ago; yet in that time over $20,000,000 worth of silver have been produced, and over $11,000,000 have been paid out in dividends up to the beginning of 1909. This distribution of 56% of the entire production to shareholders should be a fitting object lesson to some of the other great mining camps of this continent.

MEXICO.

DURANGO.

Work is now well under way at the Libertad mine in the San Diego district, near Velardeña. These mines were idle for several years until recently. José Maria Correa, the former general manager, has been called from Naica to again take charge of this work. The Libertad mine is owned by wealthy Parral capitalists and adjoin the Montañesas mine, which has been shipping high-grade ore to the Torreon smelter.——Rhodesia is the name of a mining concession, 110 square miles in area, lying to the north of Guanacevi. A company has now been organized in London with a capitalization of £300,000 to exploit this concession. Some time ago 125 pertenencias were located, and in the last few months 300 more have been taken up. F. J. M. Rhodes is the manager on behalf of the London proprietors.

The American Zinc Extraction Co. has purchased the property of the Parral Milling Co., and has begun tearing down much of the plant in view of installing newer types of machinery. Tests have been made in Kansas City of the ore the company expects to treat, and the initial capacity of the new plant will be 100 tons daily. The representatives of the two companies who effected the deal are Rowe & Swain, for the American company, and José Botello, for the Mexican.——It is reported that the Montreal company which has supplied Pachuca and Guanajuato with electric power has made plans to do the same for the Parral district, by building a hydro-electric power-plant on the Rio Conchos.

FEDERAL DISTRICT.

The Mexican Mining and Metallurgical Institute met at the American Club, and adopted the official name of 'Instituto de Minas y Metallurgia.' Bernard MacDonald was elected president, and there were also present: A. Grothe, E. DuBois, W. H. Blackburn, E. P. Merrill, G. H. Garrey, George E. Farish, H. S. Denny, J. D. Helm, Kirby Thomas, Marion L. Thomas, J. Leslie Mennell, E. Ordoñez, Godfrey D. Doveton, Clive S. Newcomb, R. H. Anderson, J. C. Brennon, W. M. McNeely, H. Simpson, Victor M. Braschi, P. A. Babb, F. Narváez, H. A. Barker, J. B. Empson, E. Girault, J. W. Johnson, H. C. Enos, H. L. Lawrence, and Richard H. Chism. The next meeting will be on March 25.



View on Guanajuato.

GUANAJUATO.

A vein, believed to be the continuation of the Nopal lode, is being opened by two drifts on the 300-ft. level of the Nueva Luz mine. The same vein also shows in the *socavon* at a higher level, and is there 5 ft. wide, carrying over 500 gm. silver per ton. The manager, M. Heinrich, is subordinating work on this vein in favor of active development on the Valenciana ore-shoot.

HIDALGO.

The Pachuca Mining Co. has let a contract to John Hooper to sink the three compartments of the Edward VII shaft a depth of 200 metres, it being now about 98 metres deep. Cross-cuts will be driven north and south to intersect the lodes known as Analcos and Remedios. The shaft is situated in a claim immediately to the south of the La Blanca and Santa Gertrudis mines, and so the development in depth will be watched with interest. ——The tunnel No. 3 of the Santa Ana mine at Pachuca is now in 1273 ft., and within a month will tap the intersection of the Santa Ana and Capula veins at a depth of 600 ft. This work will prove the extremities of the vein for a distance of 2500 ft. The work on this property is at present self-sustaining.

JALISCO.

James P. Harvey and H. L. Percy, of Los Angeles, are in the United States making arrangements for a concentrating plant with a daily capacity of 200 tons for the Magistral copper mines in the Ameca district. The Magistral mines were purchased last October for ₱100,000.——Marcus Daly and Ernest A. Wiltsee, of New York, have just made an inspection of the Cinco Minas in Hostotipaquillo. These mines, which are famous *antiguas*, were recently taken over by the Daly estate and a preliminary payment of ₱50,000 made. The balance due is ₱480,000, and it is probable that this amount will be paid immediately. The Daly interests plan a modern reduction plant at the mines, and a wagon-road to connect with the Southern Pacific extension.—— The Lawson Development Co., of which Thomas W. Lawson of Boston is president, has resumed work on its custom mill on the San Geronimo *hacienda* in the Mascota district.



Part of Jalisco, Mexico.

The plant was nearing completion when all work was stopped more than a year ago. A deal is now on for the Mascota properties of the Santa Lucia Mining Co., a Philadelphia concern, in order to increase the available ore supplies.

SONORA.

News comes from Douglas that the Phelps-Dodge Co., which owns the Copper Queen and dozens of other mines and railroads in the territory, is to acquire the El Tigre gold mine, some 50 miles south of the international line at Douglas. This is possibly the only mine in the western country that was ever stolen bodily after it had become a producer. B. F. Graham and others sold the mine to Kansas City parties for $650,000. Claiming default in payment on a technicality, they rushed an armed force into Mexico, took forcible possession of the property, and began to work it as their own. After a long and tiresome trial in the Courts, the Mexican Government restored the mine to the Kansas City owners, who are now about to sell the mine to the Phelps-Dodge Company.

W. G. McBride, of the Sonora Consolidated Mines Co., is making arrangements to work his property, which he asserts contains ore running 20% copper, 30 oz. silver, and $4.50 gold. It is situated six miles from the Cabullona ranch and 16 miles south of Douglas.

Special Correspondence.

LONDON.

Exploration Co.—San Francisco del Oro.—Le Roi No. 2.—Ymir.

The Exploration Co. and the chairman, R. T. Bayliss, are to be sincerely congratulated on the results obtained during 1908. A year ago it was necessary to refer to this company as being hard hit by misfortune, notably due to the collapse in copper and to the consequent depreciation of copper and other shares. Since then the debit balance has been wiped out and a considerable balance remains to credit. For the year 1908 a net profit of £59,979 has been made, out of which £37,500 has been distributed as dividend. In addition, the company has now cash resources to the extent of £2,255,974 and the investments stand at £492,528. Among the investments, Mexican gold mining shares stand for £56,000, South African shares £52,000, real estate in Johannesburg £97,000, and shares in copper companies £199,000. The copper companies include the Greene-Cananea, Butte Coalition, Nevada Consolidated, and the Otavi. An interesting announcement has been made to the effect that Mexican mining is to receive special attention in the future, and that a separate company is to be formed for the purpose of testing and developing properties in that country. The capital is to be £250,000, of which the whole will be subscribed by the Exploration Company.

One of the Mexican properties owned in London, the San Francisco del Oro, has up to the present time given its directors and shareholders a good deal of anxiety. The ore is a complex zinc-lead sulphide containing gold and silver. Owing to the scarcity of water, concentration presented difficulties, and rich shipping ore was relied upon for income. Many experiments were made with dry concentrators, but without success. Some months ago a fortunate discovery of water made during development operations, altered the aspect of the case. It was decided to try the system of concentration adopted at Broken Hill, and the matter was referred to W. E. Simpson, who has had special experience in that problem at the works of the Zinc Corporation. He is also known as a successful metallurgist at Lake View Consols and Oroya Brownhill in Kalgoorlie. His experiments showed that the Broken Hill practice was suitable for this ore, and that large proportions of lead and silver may be readily saved. The question of treating the zinc residue will be investigated later, on the spot. Mr. Simpson has been appointed general manager, and is leaving for the mine immediately. It is not expected that more than £5000 will be spent on re-modeling the plant, for there is already an excellent equipment, and the company has this amount in hand. At first the modified plant will have a capacity of 100 tons per day, and further expansions will be decided on when the duty of this unit has been ascertained. Apparently a troublesome problem has been solved which will lift the company from misfortune to success.

The prospects at the Le Roi No. 2 at the present time are better than during any period in the life of the company. It is now about five years since the present board took command and placed the management in the hands of Alexander Hill & Stewart. At first the outlook was far from bright, and the managers held out no large hopes. However, by careful and systematic examination, sufficient ore was found to keep the mine going and to yield profits. In the meantime prospecting with the diamond-drill has proved the existence of large bodies of good ore. Most of the ore extracted during the last few years has come from the 300 and 500-ft. levels, on the Hamilton vein. Diamond-drilling along the course of the vein has shown it to continue to the 700-ft. level, and the drillings give an average of over 2 oz. gold and 2.8% copper. Concurrently with this exploration, similar investigations have been made at the bottom of the mine from the 900-ft. level. At depths between 1200 ft. and 1300 ft. a vein has been struck, which is apparently a continuation of the Le Roi south vein, belonging to the adjoining company. It is figured that the vein is 7 ft. wide and assays 1 oz. gold and 4¼% copper. In the adjoining mine the vein is being worked at the 1650-ft. level in good ore, so that the prospects at the Le Roi No. 2 are favorable. The main shaft is being re-timbered in part and preparations are being made for sinking below the 900-ft. level. To meet these expenses funds are being accumulated from revenue. The profit for the year 1908 was £53,053, of which £37,800 was distributed as dividend. The ore shipped amounted to 29,648 tons averaging a little below 1 oz. gold and 1½% copper, with a gross value of $23.60 per ton. In addition 15,044 tons of low-grade ore were milled yielding 1129 tons of concentrate averaging 1 oz. gold and a trifle less than 1% copper, but it is an ore that does not concentrate well.

Exploration by diamond-drilling in British Columbia has become the basis of an enterprise determined upon by the directors of the Ymir Gold Mines, Ltd., to issue £20,000 new capital for the purpose of exploration by such means. For some time R. Gilman Brown has been studying the Ymir deposit, and has investigated both the old vein and new ground. The old vein yielded good returns in the earlier days, but it became erratic in depth, and its exact nature is still not known. At a point 200 ft. below the surface, and 800 ft. from the old vein, a detached mass of high-grade ore was found. This mass is probably connected with another vein, according to indications, and it is chiefly with the object of finding this other vein that the additional capital is being raised. The Ymir is an excellent plant, consisting of 80 stamps, concentrators, and cyanide equipment, all driven by water-power. It is situated at the mouth of the adit, or 1000-ft. level. The risk of £20,000 in further exploration seems amply warranted.



Mexico Mines of El Oro.

DENVER, COLORADO.

Conservation Commission.—Vidler Tunnel.—Oil Prospects.—Cripple Creek.—San Louis Valley.

The Colorado conservation commission, composed of 36 prominent business and professional men, met in the Chamber of Commerce building, at Denver, on March 11. After effecting a permanent organization, committees were appointed to consider forestry, water, lands, minerals, natural history, and legislation. The commission will meet again on May 14 to hear the recommendation of the committees, and to take further action. It is to be hoped that this commission will bring to public notice some of the more noticeable wastes in mining, as well as in the industries which touch the more visible resources of the State. Probably in no other State are there more extensive coal beds lying so near the surface as in Colorado, and the waste in extraction in many districts is almost criminal. The trouble lies largely in adopting methods unsuited to the conditions. If the commission turn the attention of engineers and oper-

ators in this branch of mining to the art of saving as well as of getting, it will do a great service to the State.

There seem to be indications of an active season in the east Argentine district. The Vidler tunnel, which was originally started through Gray's peak for mining purposes, is to be enlarged into a railroad tunnel, for the Argentine Central railway. The tunnel enterprise was in the hands of an English company, and did not thrive under the 'absent treatment.' The company has been re-organized by local men, work has been resumed, and, with both the mining companies and the railroad interested in its success, the driving of the remaining 2800 ft. will be a short job. The distance from Leadville to Denver, by this new road, will be some fifty miles shorter, with much easier grades than by the present route.

An oil well, flowing 150 bbl. per day, has been developed in the Boulder oil field. This has stimulated others to such an extent that two new wells are being drilled, and contracts have been let for six more. The region south and east of Colorado Springs is still being prospected. Good indications have been found in some wells, but nothing new has developed.

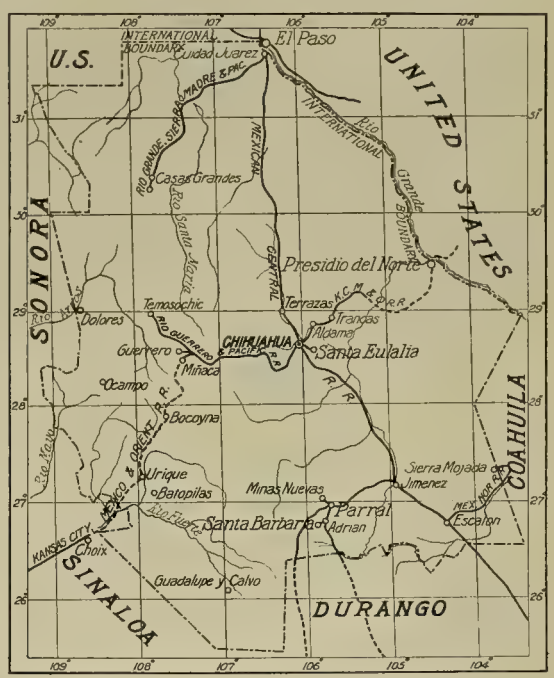
The Cripple Creek production is meeting the usual influences for increase and decrease. Since Allan L. Burris became president of the El Paso Consolidated Mining Co., it has been decided to work the property on company account. The lessees have been given notice that their leases will expire on May 1, and they are making endeavors to remove all the ore possible before that time. On the other hand, the pumps on the bottom level of the Strong mine have been shut down. This will decrease the production from the lower levels of the Portland, Ajax, Granite, and Dead Pine mines. It was from these workings that some of the richest ore in the camp was produced. The trouble seems to be that the companies which benefited by the pumping are not willing to bear a part of the expense.

Several companies, with irrigation projects in the San Louis valley, have been disappointed recently by the decision of the Reclamation Service to refuse title to any more reservoir sites in the valley. The reason given is that the water is needed in the Engle, New Mexico, reservoir, so that the United States can furnish to Mexico 10,000 acre feet. The parties interested are protesting vigorously, claiming that the surplus water to be stored in the reservoir is to be used to irrigate private land, some of which has never been reclaimed.

MEXICO.

Chihuahua & Pacific Ry. — Railroad to Cananea.—Coahuila Coal. — Tariff on Coal and Coke.—Zinc Ore Production.

Word reaches us from Chihuahua that the Chihuahua & Pacific railroad, running west from the city of Chihuahua, has been bought by F. S. Pierson, representing a Canadian syndicate, and that he is negotiating for the purchase of the principal lumber and railroad interests of W. C. Greene, known as the Sierra Madre Land & Lumber Co. and the Sierra Madre & Pacific R. R., and that as soon as these deals are consummated the railroad will be pushed on to the West Coast. It was generally supposed that the Cole-Ryan people were after the Greene holdings, but evidently such was not the case. It is possible that the Pierson syndicate may take over the Kansas City, Mexico & Orient railroad, leading to Topolobampo in Sinaloa, but this is doubted. The difficulty of construction along the line of the Orient is great, and it is probable that the line will be sooner extended toward the northwest from Temósochic, the present terminus of the Sierra Madre & Pacific, and thus connect with the proposed road from Nuevas Casas Grandes, and so reach up to Cananea. This would be in accord with the concession which Greene had for the Sierra Madre & Pacific R. R. Thereby three feeders would be secured, one west from Chihuahua, one south from El Paso through Nuevas Casas Grandes, and one south from Cananea. The completion of this line of the K. C., M. & O. would give Chihuahua two outlets to the Pacific. The timber, mining, and agricultural possibilities of the country through which these lines would pass should warrant ample returns for both. Should the proposed railroad from Monclova, State of Coahuila, to the city of Chihuahua, also be built, the production from the Coahuila coalfields would have, by the two lines west from Chihuahua, an outlet to the States of Sinaloa and Sonora. This Monclova-Chihuahua line is not removed from the list of probabilities, for the preliminary reconnaissance was made by National railroad engineers some years ago, and undoubtedly both the States of Coahuila and Chihuahua would assist in the construction. In fact it is stated that Coahuila has offered a subsidy of ₱5000 per kilometre. The coalfields of Coahuila need a larger market, for the production already appears to have exceeded the demand. The Rosita fields were taken over from Arturo Longega several years ago by Ernesto Madero, who interested English capital with him and so opened an immense production. These mines recently have been forced to curtail their output. The Mexican Coal & Coke Co., which has been the largest producer for many years, has cut the coal at 960 ft. in its new 24-ft. shaft, and it is


U.S.
INTERNATIONAL BOUNDARY
Ciudad Juarez
El Paso
UNITED STATES
SONORA
COAHUILA
CHIHUAHUA
DURANGO
SINALOA
Casas Grandes
Presidio del Norte
Temosochic
Terrazas
Dolores
Guerrero
Minaca
Ocampo
Bocoyna
Santa Eulalia
Urique
Batopilas
Minas Nuevas
Parral
Santa Barbara
Adrian
Escalon
Choix
Guadalupe y Calvo
Sierra Mojada
Jimenez
Rio Grande
Rio Conchos
Rio Florido
Rio Yaqui
Rio Santa Maria
Rio Quiriego
Rio Fuerte
Rio Verde
Rio Nazas
Rio Aguanaval
Rio Salado
Rio Sabinas
Rio Escondido
Rio Alamo
Rio Salado
Rio Grande
Rio Bravo

sent abroad to pay for foreign coal. Their contentions are perhaps more soundly based than the zinc producers of the United States now calling upon the Congress at Washington for a duty upon foreign zinc ores, which in effect means Mexican ores. They affirm that the Mexican is cheap labor competing against high paid American labor, but they do not mention the difference in efficiency. They are taking fright because the entire zinc importation into the United States from Mexico last year was but 108,000 tons, an increase of about 25% over the preceding year, but scarcely in excess of the production of one good mine in the States. Of course, the zinc miner has as much right to protection as the lead miner, who has for many years been well cared for, but it looks as if the zinc miners are making a mountain out of a mole hill.

JOHANNESBURG, TRANSVAAL.

Report on Crown Mines.—Underground Efficiency.—Diamond Speculation.—Deep-Level Improvements.—Mine Managers' Examinations.—Floods.—Stope-Drill Trials.

The report of G. E. Webber, consulting engineer to the Rand Mines, Ltd., upon the Crown Mines amalgamation scheme has been issued, and in it he affirms that the property is destined to possess a "stability rarely, if ever before, met with in the history of mining." The operations of the producing mines of the group have already been noted, but additional data selected from Mr. Webber's report may prove interesting. The attractiveness of the Crown Mines from the investment point of view lies in its combination of security and speculativeness. Apart from the partly developed area above the South Rand dike, wherein 4½ million tons of 7.94-dwt. ore stand exposed, there is the southern area untapped by shaft or bore-hole. The ore reserves of the producing units stand in relation to their crushing capacities as follows:

	Yearly crushing. Tons.	Tons developed.	Dwt. per ton.
Robinson Central Deep	378,000	875,556	10.21
Crown Deep	474,000	1,406,838	8.8
Crown Reef	294,000	505,000	6.51
Langlaagte Deep	474,000	1,168,500	6.5

The aggregate crushing capacity is 1,620,000 tons and this will be maintained, upon the completion of the scheme, until additional tube-mills and cyanide plant are erected, which will require only a few months. Then for three years an annual capacity will be about 1,800,000 tons, subsequently to be raised to 2,000,000. Valuing the ground north of the dike on a basis of 29s. 10d. grade, and 15s. 6d. costs, a net annual profit of £1,267,000 is arrived at, while the value of the property is placed at £13,366,885.

Since the strike of miners in 1907, which ended speedily in favor of the companies, there has been a marked increase in underground efficiency. To some extent wages and contract earnings have been reduced, but the principal benefit has appeared in the raising of the standard of a day's work. Taking the ore produced per white man underground in 1908, an increase of 200 tons per annum, or 10%, can be recorded in comparison with figures for the previous year. One reason for this advance has been the employment of more highly qualified men in the positions of mine captain and shiftboss—men now mostly recruited from the ranks of technical graduates after they have served their time in the stopes and drifts. Compared with the bosses of the old school, these men may possess comparatively limited rock-breaking experience, but their wide knowledge of other departments gives them exceptional fitness for the organization of underground forces. After the strike, wages were appreciably reduced, a fact demonstrated by the Rand's aggregate distribution in wages which stands at a constant of ten million sterling annually despite the increasing number of workers. But the earnings of skilled miners have again risen, and have averaged during 1908 roughly as follows: machine-stopers, $7; machine developers, $7; hand-stopers, $5; hand-developers, $5.20. The average white wage for the Rand has been slightly reduced owing to the inclusion of several hundred white men being employed on unskilled work, such as shoveling and tramming.

It is one of the characteristic features of speculation in South Africa that, however ill a mine or district may fare, and whatever may be the magnitude of the public losses on that account, it will sooner or later be re-instated in popular esteem. A case in point appears in the re-flotation of the famous Lace Diamond mine, which was one of the most wildly-boomed gambling counters five years ago. It reappears under the title of the Crown Diamond Mining & Exploration Co. Whether the time be ripe for re-opening idle diamond mines does not affect the proposition. The only circumstances holding the public mind are that the venture is being undertaken by a strong control (Lewis & Marks), and that the former handling of the property was, of course, inefficient. The Lace mine is situated near Kroonstad in the Orange River Colony, and has an area of some 400 claims (8.8 acres), or 70 claims less than the Kimberley. Sufficient money has been subscribed to provide for re-equipment on a direct-crushing basis, which is favored in all new diamond mines in preference to flooring and weathering. Completion of plant is promised for March. The proposal is to run the mine at a capacity of 5000 loads per day, which should yield 13,000 to 14,000 carats per month.

Rand deep-level prospects improve owing to the recent remarkable results in the City Deep. When the 'reef' was first cut at a depth of over 3000 ft., the prevailing idea was that only a good spot had by chance been encountered, but this supposition has been disproved by nine months of development which have revealed a large stretch of 'Main Reef Leader' of high-pay ore. The 10-dwt. grade disclosed by the first month's work has been maintained without variation, and 560,000 tons of this value now stand in sight. Such improvement in gold-content at that depth, as compared with the standard nearer the outcrop, augurs happily for future prospects in Central Rand deep-level mining, our knowledge of which will shortly be advanced further by striking the reef in the vertical shaft of the Turf Mines at 4000 feet.

Dissatisfaction with the decisions of the Mine Managers' Examining Board has long been expressed. The feeling of distrust with the system upon which the qualifications of mining engineers for managerial responsibilities are determined, have been intensified by the results of the last examination, which were so incongruous as to occasion strong comment from W. W. Mein in his presidential address before the Mine Managers' Association. Out of 23 candidates, only nine passed. This would appear in no way remarkable if the 'failures' had not included men of proved competency; men who have handled underground forces in big mines with exceptional success and have shown themselves reliable and proficient under the hardest tests of working practice. The principle of these examinations is admirable, but the system adopted is fundamentally at fault.

The deluge which resulted in the Witwatersrand mine-flood at the end of January has been followed by a series of heavy rains which have seriously affected mining operations at many points. Over 20 in. fell in January, and the first fortnight in February has not included a day without contributions to the season's abnormal record. Several mines have been obliged to temporarily suspend milling operations owing to inaccessibility of stopes or to the necessity for devoting the hoists to baling. The February output is likely to be much lower than the January rate of production would indicate as normal for the short month. Even the January yield of £2,612,836 was affected by the floods.

The surface 'elimination trials' of the Stope Drill Competition are to be commenced immediately. The preliminary arrangements have included a series of tests for the calibration of the Kennedy air-meter, which is to be used for determining the consumption of compressed air at various pressures. Though this aspect of working results will

be carefully analyzed, within certain limits the question of air-consumption will appear of comparatively small moment in judging of all-round merit. The measuring of compressed air is a subject likely to assume special importance in a year or two, when central compressed-air stations are erected, and when the purchasers will find it necessary to have an exact record of their consumption.

BUTTE, MONTANA.

Copper Production.—East Butte. — Collapse of Ponderay Smelter.—Barnes-King.—Butte-Knickerbocker.

With one or two exceptions all the Butte mines are producing at normal rate, which means about 29,000,000 lb. copper per month. There is no copper stored in Montana. The product is shipped to Eastern refineries as fast as turned out by the smelters. Amalgamated officials admit that too much copper is being produced, but they say the Amalgamated can compete with any other producer in the world. This means that the Amalgamated, which closed its mines once before during a depression, while other producers would not even curtail their production, does not intend to 'hold the umbrella' for its rivals again. Development is being done by the Amalgamated in the Parrot and Little Mina mines, and shaft sinking is in progress on the Diamond, Badger State, and Right Bower. In the Little Mina is a good vein on the 1000-ft. level. On the 1900 and 2000-ft. levels of the Parrot mine the big Anaconda vein is being developed and is showing well.

It is said that Frank M. Sullivan and Patrick Wall, who organized the East Butte Co., have disposed of their holdings in that company to Boston people, and that the control of the company is now in Boston. Mr. Sullivan still remains a director of the company.

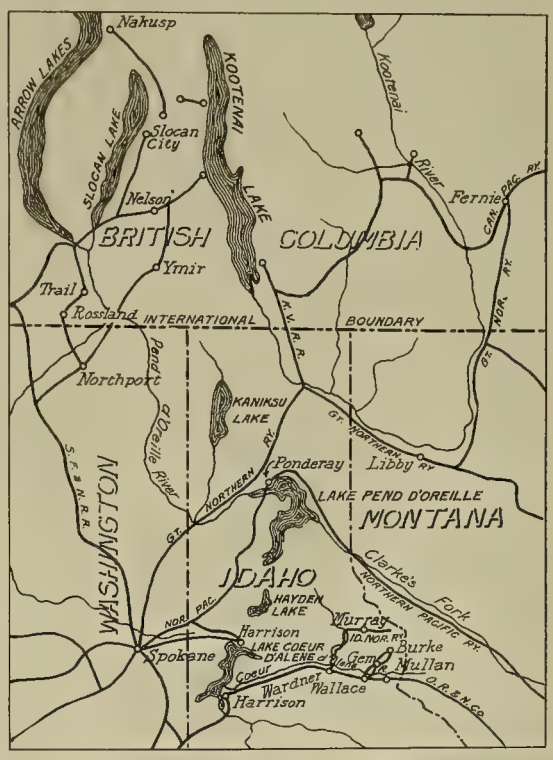
The Panhandle smelter at Ponderay, Idaho, owned by the Idaho Smelting & Refining Co., in which the Montana Mine Owners' Association was a large stockholder, has been placed in the hands of a receiver, through the action of the Greenough Brothers, principal stockholders. The Montana Association had hoped to be able to circumvent the smelter trust by furnishing a smelting plant for the use of independent producers, but it did not meet with much success, even from the persons and companies in whose interests the association was striving, while it found hostility and opposition on the part of the big producers, the smelter trust, and the railroads. The Panhandle smelter accumulated an indebtedness of about $200,000 under a former ownership and which was assumed by the present company. There are also bonds outstanding. No ore will be received while the plant is in the hands of the receiver, but the ore in the yards will be treated by him. It is said that the assets of the company will not exceed $250,000, while the liabilities are more than $400,000. It is likely that the plant will be sold and the proceeds applied to the debts, after which there will be another smelter organization. It is believed that the Greenoughs desire the property for the treatment of their Snowstorm ores.

The Snowstorm Mining Co. struck water in the No. 4 tunnel and the stock buyers jumped at the conclusion that the opening had reached the Snowstorm vein, but it would appear that something like an underground lake instead of a vein has been cut. The last shot fired released such an immense volume of water that the men narrowly escaped with their lives, and the flood tore things disastrously in the tunnel. The water has been flowing so heavily ever since that no work could be done, and it will be sometime before the damage can be repaired.

At the annual meeting of the Barnes-King Development Co. the following directors were elected: John Gillie, C. W. Goodale, Phil. C. Goodwin, L. O. Evans, and Donald Campbell, of Butte, John L. Bright and Wilford Johnson, of Lewistown, Montana, and W. H. A. Fischer, of New York. As there was not a quorum of directors at the meeting, officers were not elected, but a meeting for that purpose will be held March 20 in Butte. The net monthly earnings for a year past have been from $1000 to $5000. Prior to that the company lost money rapidly. The company has a balance of about $230,000 in the treasury.

The stockholders of the Butte-Knickerbocker Mining Co. was held in Butte the past week and the following directors were elected: George H. Roberts, of Boise, Idaho, F. L. Cobb and Edward Higgins, of New York, B. F. White, of Dillon, Montana, James Davidson, William Dyer, E. E. Kinerk, J. F. Saville, T. W. Bradley, J. M. Montgomery, and George B. Conway, of Butte. Mr. Conway was elected president, Mr. Davidson vice-president, Mr. White treasurer, and Mr. Dyer secretary. The company owns a group of 14 claims in the Butte & Bacorn section of the Butte district, and while nothing has been done on the property for more than a year because of the financial depression, the company is now planning to resume work.

The new North Butte Extension Development Co. seems



Boundary and Coeur d'Alene Districts.

to have a bitter enemy, who is able to get some annoying stories into the newspapers. It was recently published that the company had lost its most important mining claim by failure to do assessment work. The facts are that after the original group of claims had been surveyed, it was found that there was a bit of unappropriated ground, less than half an acre, lying near the other claims. John A. Ryan, the superintendent, located it for the company. It has value only as surface ground, but when Mr. Ryan's services were dispensed with by the company, which abolished the position of superintendent, a friend of Mr. Ryan made a location of this fraction, and the story was sent out that the company had lost its best claim. If the company needs the ground there isn't a chance in the world that it will lose it. Another story was that the company's property had again been attached. It had, in fact, but that too was part of a plan of annoyanc. The former superintendent had rented a pump for the old company, and when operations were suspended, instead of taking the pump out of the mine, he left it at the 500-ft. station. It was soon several hundred feet under water, and the owner eventually brought suit for the rental that would have accrued. As soon as the New York officials heard of the suit, money was telegraphed to Butte for the purchase of the submerged pump without further question.

The settlement of a $10,000 judgment obtained by Alonzo

W. Evans of Cleveland against the Lake Shore Gold Mining Co. is contested by Evans' Butte attorney, who refuses to dismiss the attachment, and threatens to proceed against the property under the Evans judgment to satisfy his fee of $2500. As he has possession of a block of stock under attachment he will probably win. The Lake Shore Co. has been re-organized. It owns a good mill, but its property, according to reports, is of little value.

NEW YORK.

Electric Smelting. — International Smelting Corporation. — Copper Situation.—Market Conditions.

It was recently announced that the United States Steel Corporation had decided to equip its works with electric smelting furnaces of the Heroult type. This furnace is extensively employed in steel works in France and Sweden with satisfactory results. In Germany, Switzerland, and Italy the Stassano furnace is chiefly employed. Within the past few weeks the Bonner Fräserfabrik, at Bon, has replaced its crucible steel plant by Stassano electric furnaces for the production of all the hard and mild steel used in the factory. Each furnace has a capacity of one ton of steel. The steel in this factory is made from iron turnings and factory scraps valued at $15 per ton. The entire cost of converting it into steel amounts to $29 per ton. Each furnace converts a ton of filings into a high-grade nickel steel in five hours. Each furnace requires two men to look after it, and absorbs 900 kw.-hr. of current. The Heroult furnace, however, is probably better suited to American conditions.

Several companies are negotiating for the purchase of the various properties of the insolvent Greene Gold-Silver Mining Co. in Chihuahua, Mexico. A Canadian company has taken an option on the large timber leases which formed one of the principal assets of the defunct concern. The representatives of the Rothschild Exploration Co., of London, are sampling the mines. It is believed that the Greene company's troubles were caused by bad management rather than through defects in its properties.

The International Smelting Corporation, the recently organized auxiliary of the American and Mexican copper trust, has purchased a number of the mines and smelters on which it had options. A meeting of the directors will be held in New York shortly, after which an announcement will be made relative to the Corporation's recent purchases and its public rates for smelting copper ore. It is estimated that the properties just purchased will enable the Corporation to declare a 10% dividend on its first year's operations. The Copper Producers' Association has issued its second report covering the statistics for the month of February. Production was placed at 114,793,000 lb., or at the rate of 3,703,000 lb. per day. The production in January was 112,136,200 lb. The copper stocks at present on hand in the United States amount to about 180,000,000 lb., or about four months' normal consumption. The announcement of these statistics depressed the copper stocks listed on the New York Stock Exchange, and gave rise to an abundant supply of gloomy predictions relative to the future of copper. Speculators in the metal are loud in their complaints against the copper miners for not taking concerted action toward relieving the present excessive supply. The outlook, however, is not so bad as it is painted. It is possible that a further cut may be made in the price of copper, with the view of inducing manufacturers to come into the market for larger quantities of the metal. But prices will not continue low very long. During the past fortnight European speculators have purchased a large proportion of the stocks on hand for purely speculative purposes. They are taking advantage of the low rates ruling for money to acquire copper for an early rise. Their plans have been conservatively laid, and these extensive purchases must be taken to indicate the betterment of the copper market in the near future. The stock market continues quiet. Fluctuations in prices range within three points. The industrial stocks are particularly sluggish. These conditions will probably continue a few weeks longer, until investors learn from the Congressional debates the trend of the factors influencing tariff reform. The prevailing opinion in financial circles at present is that the revision will not be sufficiently serious to effect stock values. The anxiety appears, not so much as regards the proposed changes in customs imposts, as to the attitude of the representatives in Congress of the various trusts. The proposed reductions of the duties on iron ore, steel, and iron have already been discounted on the stock and metal exchanges. Brokers on the curb market report improving business in mining stocks. Nevada and Mexican gold mining stocks are much in favor.

TORONTO, CANADA.

Mineral Production. — Cobalt. — Notable Technical Papers.

J. McLeish of the Department of Mines, presented at the recent meeting of the Canadian Mining Institute a report on the mineral production of Canada in 1908, showing that the output was the largest in the history of the country, being valued at $87,323,849, as against $86,842,765 in 1907, this in spite of the large decrease in the prices of metals. Had the high prices of the previous year been maintained, last year's product would have been worth $8,000,000 more. J. Obalski, Superintendent of Mines of Quebec Province, made a statement showing that the value of the mineral output of the Province was $5,493,664, the production of asbestos alone being valued at $2,551,596, while that of cement was $1,127,335. The number of men employed in the mining industry was 6324. Thomas W. Gibson, Deputy Minister of Mines for Ontario, presented a statement giving the statistics of mineral production for 1908, the total value amounting to $25,219,609, as against $25,019,373 for 1907. While the figures showed a considerable shrinkage in non-metallic production, the metallic output was $16,705,647, as against $14,550,835 in 1907. The items under this head were as follows:

	Quantity.	Value.
Gold, oz.	3,465	$ 60,337
Silver, oz.	19,424,781	9,125,903
Cobalt, tons	1,224	110,166
Nickel, tons	10,175	1,866,059
Copper, tons	7,561	1,071,140
Iron ore, tons	199,395	537,379
Pig iron, tons	271,656	4,390,839
		$17,161,823
Less value Ontario iron ore (170,215 tons) smelted into pig iron		456,176
		$16,705,647

The output of silver from the Cobalt district nearly doubled. Returns from 29 shipping mines showed ore and concentrate shipped amounting to approximately 25,497 tons, containing 19,296,430 oz. silver, as compared with 14,644 tons, containing 9,982,363 oz., in 1907. At the average price of refined silver for the year the production of 1908 would be worth $10,200,865, representing an average return of 756 oz. silver, or $400 per ton of ore shipped. The output of last year would probably place Canada in the third place among the silver-producing countries of the world.

At the sitting on March 4, S. F. Emmons, senior geologist of the United States Geological Survey, discussed the various theories of ore formation, tracing their development, and showing the predominance of the view that ore deposits are largely connected with volcanic action. He emphasized the great value to the American mining industry of the careful work of the Geological Survey, and urged upon Canadians the importance of detailed geological examination of mining districts. Waldemar Lindgren, of the U. S. Geological Survey, dealt with the subject of 'Metallogenetic Epochs', contending that at different eras, different kinds of metal had been deposited. From a comprehensive review of the ore deposits of the United States, he adduced many facts in support of the opinion that various periods were characterized by particular ores. The paper excited interesting discussion.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Voltages used on electric circuits underground vary according to many conditions, 440 being a common pressure for electric pumps. Alternating current is usually employed.

Zinc-dust as a precipitant is coming into quite general use on the Rand. At the Homestake mine in South Dakota, the zinc-dust is specified to contain 2% lead, thus taking advantage of the internal zinc-lead couple to promote the reaction with the cyanides of the precious metals.

High duty in stamp-milling is the order of the day in South Africa. At the West Rand Consolidated mine 1800-lb. stamps are being installed, which will crush 12 tons each per diem. Duties of 9 to 10 tons per diem are regularly attained by stamps weighing from 1400 to 1600 lb. in the gold mills of the Transvaal.

Rational analysis is a term sometimes used to designate an approximate determination of the mineral ingredients in clay, soil, or other substance resulting from rock-disintegration, as distinguished from chemical analysis. In the case of clays the 'rational analysis' takes account of kaolin, free silica, and feldspar.

A mining claim open to valid location is necessarily open to re-location by a former locator, but if a claim is open to re-location by virtue of failure to perform assessment work, and no one has placed an adverse location upon the ground, the original title is continued by the former locator resuming work upon the claim. This is preferable to re-location.

Amount of principal and interest, when interest is compounded, may be calculated by the formula

$$A = P(1 + r)^n$$

in which A equals amount of principal and interest, P equals principal, r equals rate per cent per annum divided by 100, and n equals number of years. For example, \$500 at 5% for 10 years would produce $500 \times 1.05^{10} = 500 \times 1.62889 = \$814.445$. The factor r to the required power may best be worked out with logarithms, or with the slide-rule.

Lightning discharge, estimated from its light, according to Charles P. Steinmetz, develops an energy of 10,000 kw.-seconds. This is not as high an energy as had originally been suspected, and expressed in heat-measure it represents the latent heat of evaporation or condensation of 9 lb. of water. But estimating as disruptive strength of air under discharge conditions in a non-uniform field, the average potential gradient in the path of the lightning discharge through the clouds would be about 50,000 volts per foot.

Railway rates in Canada are fixed by a Commission of three appointed by the Governors in Council, the term of office being ten years. The Governors have power of removal as well as of appointment. The Commission has absolute power over rates, classification, speed, safety appliances, and the like. The railways may submit tariffs, but these are rendered effective only by authorization of the Commission. The burden of proof to show that difference of treatment does not amount to unjust discrimination rests upon the transportation company.

Stannary is a name applied in Great Britain to tin-bearing districts. It was a recognized term in law as early as the 12th century, and a mining tribunal, known as the Stannary Court, was in existence from very early times. The root of the word was employed in many ways; for example the bounding monuments of mining claims were called stannaburrows; and the miners themselves were called stannators. Mining laws relating to the tin-producing districts are called Stannaries Acts, the latest general Stannaries Act being passed by Parliament in the year 1869.

Peridotite is by no means an uncommon rock, but is seldom found in large masses. Peridotites, often termed pyroxenites, are moderately basic rocks, closely allied to the gabbros. The differentiation of peridotite from the gabbros is marked by an increase in CaO and MgO, with a corresponding decrease in Al_2O_3. Pyroxene is the predominant mineral, the common accessories being enstatite, bronzite, hypersthene, and diallage or augite. Magnetite and titaniferous minerals are frequently found, and are sometimes present in quantities sufficient to constitute an ore of iron, as at Taberg, Sweden. A notable occurrence of this type is found at Cumberland, Rhode Island.

Gold dissolves in cyanide solution in direct proportion to the area of metallic surface presented. The area of a sphere equals the square of the diameter multiplied by 3.1416 ($A = \pi d^2$) and the volume equals $^1/_6$ of the product of the cube of the diameter and 3.1416 $\left(A = \frac{\pi d^3}{6} \right)$. Therefore, to take the simplest conditions, if a gold particle has a diameter of 1 mm., its volume will be 0.5236 cubic millimetres, and its area 3.1416 square millimetres. For a sphere of 2 mm. diam., the corresponding figures are 4.1888 and 12.5660. The ratio of volume to surface in the larger particle is as 1 to 3, while in the smaller it is as 1 to 6. At ½ mm. diam. the ratio becomes 1 to 12, and so on. The economical limit of size is one to be determined in the light of results. With relatively coarse gold the time of contact must be prolonged to insure high extraction. For a large tonnage it pays to install expensive machinery for fine grinding in order to obtain quick extraction by slime-treatment; for a small tonnage leaching would be cheaper. It is purely a question of what pays best, which must be ascertained by experiment. In general it may be said that gold particles, to be susceptible to economical leaching by cyanide solution, should be smaller than 0.01 inch diameter, or 0.25 millimetre.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Geological Hierophants.

The Editor:

Sir—Light-hearted jocose references to the language used in scientific writing have appeared frequently in your editorial columns, and since in your issue of February 27 you honor Mr. Calkins and me with a column and a half of such levity, it seems only fair that your readers should have a sober statement of the other side of the question.

You premise that "the reports of the Survey are intended primarily for the use of the people in the mining district serving as the subject for investigation, and after them for people interested in mining geology in the United States, and finally for scientific men." It will serve, merely for the purpose of this discussion, to accept your view, with due thankfulness moreover that you have not entirely ignored the third class.

Now the paragraph that you have illuminated with your wit and which happens to have been written by Mr. Calkins, is not, as would be inferred from your remarks, the general style of the report nor even of the chapter in which it occurs. It is found, not in the part devoted to the ore deposits, but in what is intended to be a scientific treatment of the general geology. Furthermore it is in a section that deals with the essentially technical subject of the petrography of the igneous rocks. Finally, it stands by itself as a single paragraph after the rock referred to has been described as "porphyritic syenite" and after a clear simple account has been given of its texture and mineral components. In other words, after the "average citizen" has been treated with all possible consideration for over a page, the position of the rock in a modern scheme of classification (in use by the way in the geological surveys of the United States, Canada, British Guiana, and New South Wales, and in petrological papers published in many journals and in various languages) is briefly given in words that are an integral part of that scheme and are the only ones available to convey the desired information to a trained petrographer. No writer can possibly indicate the classificatory position of a rock in this system without using the precise terms employed by its authors in their book published six years ago, of which you appear to be unaware although it is obtainable through any dealer in scientific books. Furthermore, the quantitative system is explained in Chamberlin and Salisbury's standard text-book on geology and is briefly treated with reference to more comprehensive expositions in Pirsson's elementary book on 'Rocks and Rock Minerals'. In view of these facts, which anyone who cares to can verify with little trouble, it appears that we have a deal of barking up an empty tree and that a reader more interested in the matter of the report than in finding jokes for his editorial page need not have been greatly troubled because a rock mapped and described as 'syenite' is, in a single short paragraph, said to be named 'monzonose' in a certain well-known scheme of nomenclature.

After all, Mr. Editor, the professional papers of the Survey are occasionally read and used by scientific men as well as by laymen, and readers like yourself who suppose that Penfield (instead of Pirsson) had anything to do with this system of rock classification and see in it only something humorous may skip such paragraphs as the one you quote without any loss of self-respect and without the necessity of clamorously exposing an ignorance in which there need be no shame. Unfamiliarity with the terms of a specialty not his own is excusable in any man; but it is otherwise with that self-centred complacent attitude of mind that demands the expression of all knowledge, no matter how technical, in terms of its own daily use. Such a demand, carried to its logical conclusion, implies of course that it would be possible to explain the principles of modern chemical theory to a Fiji islander in his own tongue. That men like Huxley and Tyndall were able to expound some of the great results of science to thoughtful workingmen shows how clearly these investigators reasoned and spoke, and has left us all their debtors; but their audiences probably little realized how laborious was the task and how small a part of the total scientific experiences and achievements for which the speakers stood was communicable in popular language.

You have insisted often and well that a writer should remember his readers. But which reader? All classes of them or one only? A scientific man who prepares a paper for the *American Journal of Science*, for example, has little difficulty in this respect; he may express his results in the precise accurate phraseology that has grown with his branch of science and which enables him to say in one word what might require pages of explanation burdensome both to himself and to his well informed colleagues. In such a place a good writer will never use a word merely because it is strange or imposing in appearance nor will he hesitate to use the fit word merely because it is not in the vocabulary of ordinary life. On the other hand, the writer of an official report on a mining district labors under difficulties that few appreciate. His subject is intricate and far-reaching and necessitates incursions into various departments of science to the growth of which his investigations should contribute. But his audience is heterogeneous, ranging from the unlettered prospector who slowly follows with his forefinger the description of some lode or claim, to the well-trained investigator who rightly expects to find scientific problems treated with the conciseness, thoroughness, and penetration that belong to scientific exposition of the highest grade. Between these are readers of all degrees of intelligence and of many kinds of education and training. A little thought shows that the solution of this question, like that of so many in actual life, lies in compromise. To suppose that a report on the geology of a district like Cripple Creek

can be written so as to be intelligible in all its parts to every inhabitant of the district is clearly absurd. The writer, if his work is to have any value above that of a mere newspaper article, must suppose his readers to have some knowledge of chemistry, physics, mineralogy, petrography, geology, and the English language. That he should write as clearly as possible and should so far as is practicable segregate the most abstruse portions of his work so that they can be passed over by those unable to cope with them is obvious. It is not to be expected, however, that any one reader of a thorough scientific report on a mining district, unless he is himself a well-trained geologist, can comprehend all of its pages; but he may profitably remember that matter meaningless to him may be the most useful to others and that it is not possible to include in every geological work, elementary and advanced treatises on the various branches of allied science, a dictionary and reprints of pertinent periodical literature.

In conclusion, I request that having had your jokes at our expense you will do us the justice and courtesy to print this reply without facetious comments. If it may serve to evoke some serious discussion of the problem of making geological reports on mining districts more useful and instructive to all interested—miners, editors, investors, and scientific students alike, Mr. Calkins and I shall feel that we have pointed a moral to some real purpose. We may appropriately express, moreover, the earnest desire of many that reputable mining journals should at all times rise superior to the practice of deliberate misrepresentation and exaggeration of a kind that appeals to ignorance and prejudice and which characterizes particularly that part of the daily press in which sensationalism is exalted high above truth.

F. L. RANSOME.

Washington, March 8.

Protection of Investors.

The Editor:

Sir—Apropos of the recent discussion by the Pacific Coast division of the Mining & Metallurgical Society of America, may I be permitted to make a suggestion? It would seem sequentially appropriate and another effective stroke at the root of evil to take up the subject: 'How shall mining engineers be protected against unscrupulous company directors and promoters?'

It is generally well known among mining engineers that it is not uncommon practice for promoters or directors to 'cull', distort, and re-arrange the sequence of figures and statements contained in reports to such an extent as, while not altering the phraseology, to eliminate and obscure the original conclusions, in an effort to enthuse present and prospective investors.

When the 'hot water level' is reached with the shareholders, the sins are placed upon the head of the unfortunate engineer, after which he is suffered to escape into the wilderness. Generally the only access that the engineer has to the shareholder is through the director or promoter, and perhaps he does not obtain these manipulated conclusions until long after they have been well digested, and even though a belated protest should be filed, it would be difficult for the engineer to reach and convince the investor that he was not a party to the transaction at the time.

Of course, the engineer can have recourse to the law, but this might be distasteful for financial reasons, or the greater danger of being branded as an aggressive and offensive person to deal with. Another evil, the correction of which would be enthusiastically greeted by engineers, is the practice indulged in by presidents and other directors of companies, of dictating the technical policies to be followed, for which the engineer is made responsible to the shareholders. It might be urged that the engineer should not permit this, should resign, etc., but he may be interested in the business, and have some hope of being able to correct the condition while he remains, whereas by retiring all chance would vanish.

The excuse generally advanced by directors, for not publishing everything in their reports to the shareholders, is that some features may not be understood by the 'layman' shareholder, as a result of which a panic in the shares might be precipitated, to the detriment of all concerned. This, in the minds of some directors, justifies the frequent 'juggling' with engineers' reports.

With such fearless, instructive, and clearly stated matter as is furnished nowadays by the MINING AND SCIENTIFIC PRESS and other representative journals, I venture to say that the average shareholder should be as well equipped with knowledge of the eccentricities of nature's distribution of mineral and just as able to anticipate market fluctuations as the average company director, especially in England, where the qualifications of company directors centre largely round the rank of baronet or other distinguished title, provided, of course, that the shareholder has had the same amount of data to begin with. If not, it would indicate that the shareholder was either not fully enough advised or was possessed with inferior mental ability, and needed a guardian for his funds.

As far as I am aware, there is no fixed understanding between the directorate of a mining company and a prospective shareholder, that when the former is soliciting the sale of shares, the shareholder must place himself, body, soul, and pocket in the hands of the directors, and that many important mineralogical and economic changes will occur during their business association, of which he will not be advised, for his own good.

It seems to me that good results are sure to follow from the recommendations of the committee appointed by the Pacific branch of the new Society, and these, after boiling down the recent discussion, could be extended to the point of becoming mutually protective, alike to the investor and the engineer, to the end that there should be a means of direct communication between them, in so far as they are concerned, without straining the relations between the director or promoter and the engineer, and by which the responsibilities for good or defective financial or

engineering results, could be accurately and readily fixed.

F. C. Roberts.

San Francisco, March 2.

The Engineer as a Financier.

The Editor:

Sir—I have read Charles R. Gent's letter, published under this heading in your issue of February 27, with much satisfaction. I think that he has hit the nail on the head, and I should like to drive it in a little further. Mr. Gent submits, in contrast to the stand taken by certain of your contributors, that no judge is permitted to try a case in which he has even the least interest. This rule has been established in recognition of human moral weakness; its wisdom and justice are too obvious to need discussion. Engineers, as men, are morally not stronger than judges.

It seems to me that in this discussion there has been too little recognition of the fact that, in different walks of life, the barriers that may not be passed also differ. There are things that professional men cannot do, that are permitted to others. And of all the professions, that of mining engineering requires, perhaps, the greatest integrity, because it involves a subject of peculiar difficulty and hazard, as well as the investment of great sums upon a single man's word.

An engineer's report is supposed to be, and should be, without bias. His usefulness in mining depends upon impartial presentation of the truth, as well as upon his ability to determine the truth. An engineer when in practice acts for others, primarily. His true success must lie in correct and profitable work for others, and his reward must be confined chiefly to enhanced reputation, with the enlarged practice and increased fees resulting. I think it cannot be disputed that when an engineer finds his way to financial comfort too short and attempts to become a financier, he ceases to be, exclusively, a professional man. He becomes a business man and his business interest takes precedence. Right there is the focal point of this discussion.

A business man is supposed to be, and must necessarily be, biased. He must see things from the view-point of his own interest and he must impress that view-point convincingly upon others; for his competitors are doing the same thing, always. This is expected and permitted; furthermore, it is a recognized factor in business dealing, and, as such, it is discounted.

Professional honor and business honor differ so fundamentally that any attempt to reconcile them, by whatever sophistry, is futile. An engineer who finds that finance in connection with mines attracts him, may quite properly try that field, but he can hardly be said to play the game fairly with himself and with his public when he attempts mining finance under the cloak of his profession. As an engineer, he is expected to present the truth impartially, even nakedly. But when he undertakes a case wherein a favorable report will benefit him more than an adverse one, then he at once becomes a business man, dealing for his own interest and at arm's length, in spite of himself. If his true position were recognized and his report discounted as a business report would be, the ethics of the case would fit; but this is very rarely the case and more rarely the intention. Stripped of all arguments that have been reared to support this false position, it really amounts to this: That the underlying, unmentioned advantage that can accrue to an engineer acting as a financier (in the sense meant in this discussion), is that his report, made with the inevitable bias of a business transaction, shall be accepted, at face, as a report made by a professional man who is supposedly paid for the truth only, and whose whole interest is believed to lie in determining the truth correctly and in telling it exactly.

Is it not this unacknowledged advantage that makes necessary so much argument, so many excuses; and, per contra, that makes the field so alluring? We all know that some men have managed to gather fortunes in this field without being soiled. But how far good luck has counterbalanced rashness, we do not know. When an engineer finds the desire for wealth overshadowing the intellectual rewards that his profession offers, he should, perhaps, withdraw from practice and try finance. In most cases he will be glad to return to practice; and generally he will do so with accumulated debts and burnt fingers. If his professional record has, in the meantime, been kept clean, he may perhaps find opportunity to heal the sore places.

Arnold Becker.

Santa Barbara, March 7.

Silundum is a form of carborundum, and has similar properties; it is very hard, resists high temperatures, and is acid-proof. It is a conductor of electricity, its resistance being about three times that of carbon. The hardness is variable, and depends on the zone around the core in which it is produced; material from the amorphous zone is less hard than that obtained in the crystalline zone. Silundum is fire-proof to a high degree; it can be heated in the air up to 1600° C. without oxidizing. At about 1700°, however, the silicon leaves the carbon and combines with the oxygen of the air. Silundum cannot be melted. The electric resistance of this material depends on the kind of carbon and its hardness; made from porous carbon it has a higher resistance than that from hard carbon. The resistance depends also on the modification of the material; in the amorphous zone the resistance generally is higher than in the crystalline zone.

Ferrous iron in rocks and ores is affected by the method of preparing the sample. Mauzelius of the Swedish Geological Survey noted that fine grinding has a decided influence on the proportions of FeO and of H_2O in the powders. Grinding was performed in air, under water, alcohol, and under various other media. The explanation of the phenomenon seems to be that of "strong local heating of the grains at the moment of fracture or attrition under the pestle."

MECHANICAL ELEVATOR.

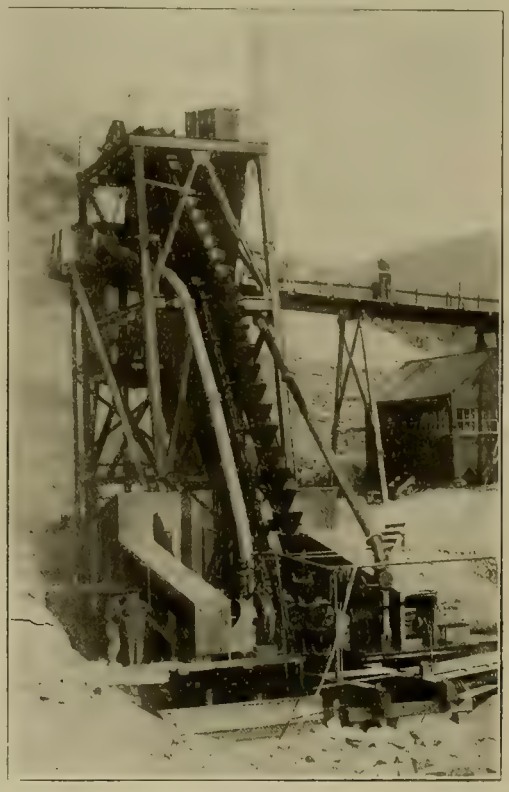
Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

Among the machines devised for the exploitation of the gravel deposits of the North, one that gives promise of usefulness is the mechanical elevator operated during the past season on Bonanza creek, near Dawson, in the Yukon Territory. I had an opportunity of examining one of these elevators while it was at work, last July. Three of the machines had been ordered by the Yukon Gold Co., and two of them were in process of construction at the time of my visit. The No. 3 elevator, so called, was at work on the claim known as 3 Above Discovery on Bonanza.

The mechanical elevator was especially designed by the engineers of the company to meet the conditions found in certain portions of the Klondike creek deposits, where the gravel is shallow and largely frozen, and where the gold itself is found for some distance within the bedrock. The method of working is a combination of hydraulicking and elevating: therefore, it involves the use of electric power as well as water under pressure.

The obstacle to straight hydraulic mining as applied to shallow creek-gravel is the absence of sufficient grade on the bedrock to sluice the gravel and dispose of the tailing. While such gravel can be dredged, and, in fact, has been dredged successfully, the chief objection to the dredging method is that the gold is distributed at varying depths in the bedrock. The inability of the operator to see the bedrock, and, in some cases, the hardness of the material encountered, render complete extraction unattainable by this method. It was to overcome the difficulties attendant upon either the hydraulic or dredging methods that the mechanical elevator was designed.

The fundamental features of the device are: (1) the creation of artificial grade; and (2) obtaining room for the disposal of tailing by the erection of a steel tower supporting the series of buckets that elevate the gravel. Thus grade is obtained at both ends of the operation.



No. 1 Elevator at 30 Below on Bonanza Creek, Showing Arrangement of Pumps

A description of the elevator will serve to make clear the functions it performs. A pit or excavation 100 ft. wide and 200 ft. long marked the area that had been stripped of gravel nearly to bedrock. The latter consisted of soft schist, tilted against the flow of the creek, so that the laminae were thrust upstream and made natural riffles. If the schistosity had been down-stream, the result would have been a



Mechanical Elevator in Operation at No. 3 Above on Bonanza Creek, Dawson.

smooth bed unfavorable to the concentration of gold. This placer on Bonanza creek was only 12 ft. deep, mainly clean gravel; the composition of the deposit varied, for it had been worked in spots in the early days, so that sundry accumulations of tailing gave additional depth. Signs of former drift-mining were indicated by old timbers. Being in a live stream there never was much 'muck' and most of it has been removed by the former operators.

At the lower end of this broad shallow pit, a steel structure stood more than 40 ft. high, carrying the bucket-conveyor. At the top, the buckets emptied the gravel into the gold-saving sluices; at the bottom, they descended into a sump or well and scooped up the material driven thither along a ground-sluice, and over the bare surface of the bedrock, by a strong jet of water delivered from a monitor.

The frame of the elevator is made of structural steel, so as to embody strength with lightness; it is in the form of a tower 49 ft. high; at the top it is 12 ft. by 16 ft. 8 in.; at the base, 12 ft. by 23 ft. 6 in. This frame rests on timbers set in the bedrock. When completed the elevator will have a frame standing on cross-girders carrying double-flanged steel wheels to facilitate moving ahead when a cut is finished. The machine is not fixed; it is intended to be shifted as the ground is worked out. Underneath, and in front of the base, is the pit that serves as a sump or well for the water and gravel. These are elevated by a close-connected bucket-line. The buckets have a 24-in. pitch, the steel bottom serving as a link between them. Each bucket has a capacity of 3 cu. ft.; there are 76 on the line and the movement is such that 24 are discharged each minute. They discharge into a hopper emptying directly into a sluice 3 ft. wide. The first sluice-box (12 ft. long) has a gradient of 10 in.; the second, 9 in.; the third, 7 in.; and the fourth, 6 in. per 12 ft. Ordinary wooden riffle-boxes are laid along the bottom. It is intended to use steel sluice-boxes with the next elevator plant; they will be lined with steel bars 1½ by 1 in. bolted to a strip of wood 1½ by 6 in., thereby making a riffle 1½ in. wide by 7 in. deep.

The pit is kept clear of the water resulting from the hydraulicking and natural drainage by a 12-in. Morris centrifugal pump, assisted by a hydraulic jet, delivering a steady flow of water to the head of the sluice-boxes. Owing to the presence of fibrous material, derived from the roots in the overburden, when stripping the gravel deposit, there has been some difficulty and interruption to steady work. The runner-chamber becomes clogged. This difficulty will be remedied by devising a pump the chamber of which will afford plenty of clearance and be readily accessible.

The empty buckets, in their descent, pass over an idler, specially designed. It consists of steel links pin-connected and shod with manganese-steel plates. This idler is essentially a chain-belt running upon stationary rollers, which are mounted on an elliptical cast-steel frame. The frame is only half of an ellipse, the links hanging free throughout the latter portion of their travel.

The vertical distance from the top to the bottom tumbler is 58 ft. 9 in. The motor stands on a platform 26 ft. above the bedrock; the drive is effected by a 50-hp. slow-speed motor belted direct to a 58-in. diam. pulley.

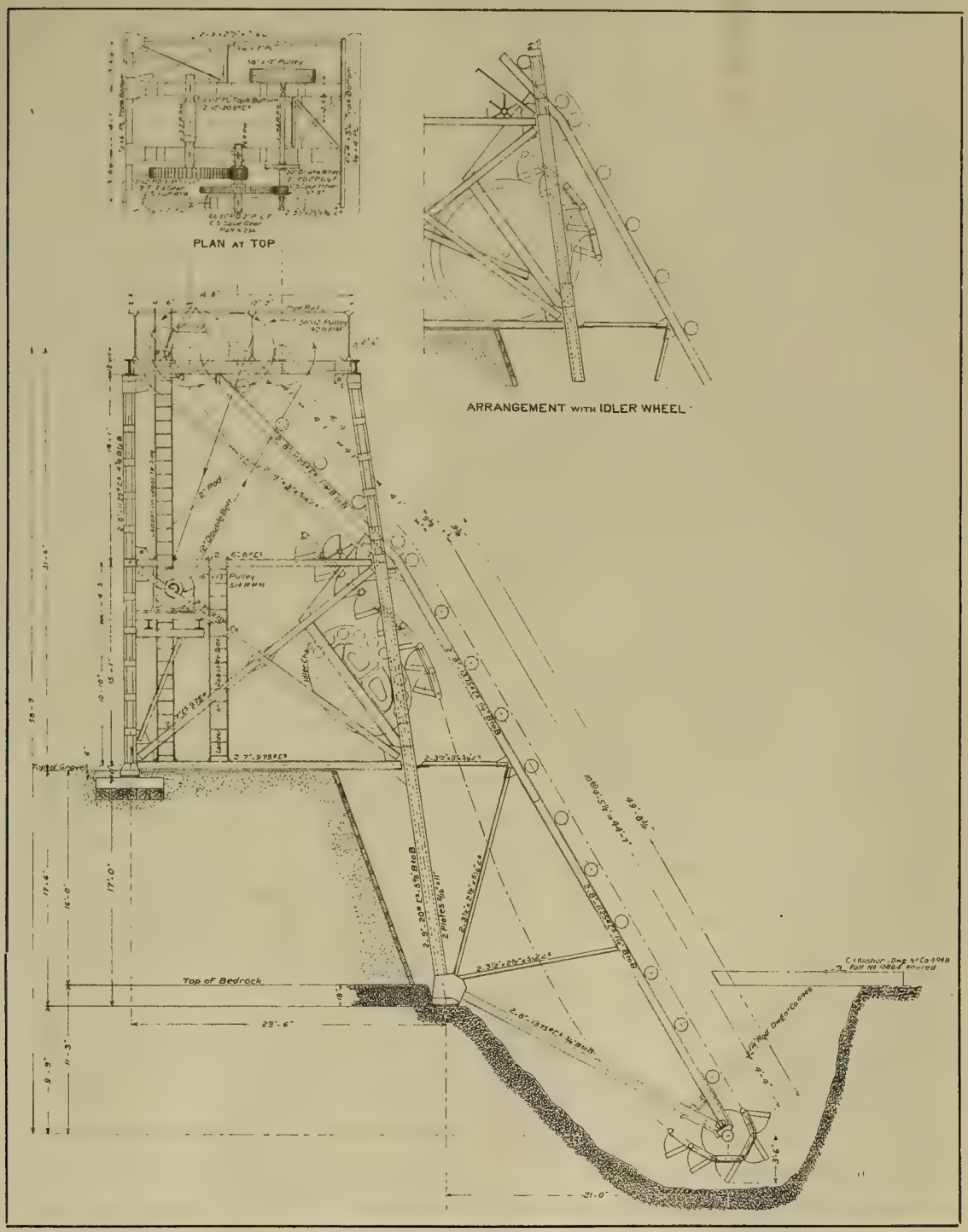
The mining operation itself consists in stripping the ground in front of the elevator by the use of monitors placed advantageously, so as to make the most of the driving power of the water issuing from the nozzle. After the ground has been stripped, the rich gravel is reached and is driven into the pit at the lower end of the excavation, where it is lifted by the chain of buckets. Then the bedrock is swept clean and as much of the soft superficially weathered rock is piped into the pit as a pressure of 140 lb. per square inch (or 350-ft. head with a 3-in. nozzle) will permit. The delivery of material into the elevator-pit is regulated by the piper or nozzle-man acting in harmony with the man in charge of the sluice-boxes. They signal to each other whenever necessary. Finally, the bedrock is dug, by pick and shovel, for about a foot deep, the fragments being swept with wire brushes and whisk-brooms into the ground-sluice, as in ordinary hydraulic mining. The object is to clean the bedrock thoroughly. One man will clean 15 to 20 feet square per shift.

The nominal capacity of the No. 3 elevator was rated at 4000 cubic yards per day; the actual work done was equivalent to 1500 yards. The buckets were about half-full; if filled, the material lifted would exceed the capacity of the sluice-boxes, which were set on inadequate grade because of lack of room for disposal of the tailing. This will be remedied when the elevator is moved up-stream. It is expected to move the plant twice, if not three times, each season. The last move would be made at the end of the season, so as to have the elevator in position ready for work at the commencement of the next season. When moving, the chain of buckets is disconnected and dragged ahead by means of a cable; the lower tumbler and the ladder structure below the level of the bedrock are also detached and shifted in the same manner. The remainder of the machine will be drawn forward bodily on wheels running over 50-lb. rails. The frame will be made rigid by stiff-legs on each side, so as to prevent tipping while removal is in progress. The power consumed in the operation of the mechanical elevator is estimated at 200 hp.; the bucket-line requires 35 hp.; and the pumps, 165 to 175 hp. From this it is evident that the pumping constitutes a large part of the work performed. Power costs $8 per hp.-month.

Some tests made by the writer with a pan proved the richness of the gravel lying upon the bedrock. Five full pans, together equal to a cubic foot, were washed. The yield from the rich layer, one foot thick, on the bedrock was $5 worth of gold, that is, $45 per square yard of bedrock. The deposit was 18 ft. deep, so that 6 cubic yards were moved per square foot of bedrock, giving an average yield of $7.50 per cubic yard. This was about double the estimate of average production at this spot, as I was informed by George T. Coffey, the superintendent of the Yukon Gold Co.'s hydraulic mining operations.

A stiff-legged derrick, with a 30-ft. mast and a

55-ft. boom, will be employed in moving boulders and heavy slabs of bedrock, whenever necessary, throwing them into a sling-chain and lifting them behind the elevator. The elevator requires the labor of 10 men per shift; this includes 1 foreman, 1 piper, 2 oilers, 2 sluice-tenders, and 4 laborers in the cut. Of the oilers, one was being initiated. The four laborers are moved from the cut to the sluice-boxes, and the reverse, as required. At the time of my visit the lack of dumping facilities was obvious; it caused the tailing to accumulate at intervals, so as to necessitate a cessation of effective work for one or two hours per day to 'pipe' the tailing. This was due to the fact that in starting the first cut the elevator was set up adjacent to a worked-out claim, which was piled high with tailing. On the next move ahead the tailing will flow into the cut worked this season, with a gain of 25 to 30 ft. in tailing-room. I am informed that later in the season an auxiliary pump was provided; this prevented much loss of time.



Mechanical Elevator, as Used at Dawson.

The No. 3 elevator operated satisfactorily until the close of the season, on October 10.

It is obvious from the above description that the operation differs from hydraulic elevation mainly in the substitution of electrically-driven mechanical elevators for the hydraulic device employed in the operations at Nome and elsewhere. A saving is obtained by reason of the high efficiency of the mechanical elevators and the cheapness of electrical power as compared to the great expense of water in the Klondike district. The experiment has demonstrated that where cheap hydro-electric power is available it is more economical to use this combination of mechanical elevators with a relatively small pressure-water installation, than to bring the large volume of water required for hydraulicking and for lifting the gravel by the ordinary hydraulic elevator. However, the mechanical elevator as used at Dawson must be deemed an experiment until the engineers in charge publish the figures of cost.

Gas-fired furnaces have many advantages over those heated by solid fuel, especially when a high temperature is required. When crucible-steel is melted in the old-fashioned coke furnaces, from 2½ to 3½ tons of hard coke are required per ton of steel melted, the exact amount depending upon the temper of the steel and its consequent fusing point. With a Siemen's regenerating gas-furnace, one ton of steel can be melted by the use of 25 to 30 cwt. of ordinary screened 'slack', costing only about 15% of the value of the fuel consumed in the coke furnaces. The total heat utilized in the melting of the steel in the Siemen's gas-furnace was found by J. W. Hall to be 2.38% of the calorific power of the fuels, as against 1.43 in the coke crucible-furnace. A hot-blast does not help matters in some gas-furnaces, as the gases are expanded too much, and local intensity of heat lost. Fletcher, who brought out a blow-pipe to work with hot air, had to withdraw it, because he found it actually reduced the temperature of the flame. Again, throwing burning gases onto cold metal checks combustion, and better results are usually obtainable by allowing ample space in which the gases may burn.

Platinum should be looked for in borax glass when testing for the presence of that metal. The finding of Pt in an ore not believed to contain it led to the examination of the assay reagents. The borax glass only was found to contain it. In the particular lot examined 1.3 parts per million were found. Borax fused in Pt dishes was found to take up perceptible amounts. The largest amounts of Pt were found in Merck's "m.g.r. puriss. borax."

Pressure-drop of steam may be figured by the formula:

$$p = 222.2\ G\ L\ v^2/D^2 \times 10^8,$$

which gives results in lb. per sq. in. G = specific weight of steam in lb. per cu. ft.; L = length of pipe in ft.; v = velocity of steam flow in ft. per sec.; D = diam. of pipe in ft. It is also found that the resistance offered by each valve in the pipe-line is equivalent to that of 53.8 ft. of additional pipe.

BEARING METALS.

As regards the characteristics of anti-friction alloys for average bearings, the structure largely depends on the composition, for while heat-treatment will affect the apparent structure, it is chiefly in regard to size of crystals. For example, the binary alloy antimony-lead, consists of crystallites of lead in a eutectic matrix if the antimony is below 13%. If over 13% crystals of antimony form in the eutectic matrix. A good bearing metal must have a hard constituent to support the load, and a soft constituent as a plastic support for the hard grains. Lead and antimony alloy in all proportions, and as the antimony increases the alloy becomes harder and more brittle. The only proportion free from segregation is the eutectic with 13% antimony. With less than 13% antimony the mass consists of crystals of lead and eutectic alloy; with more than 13% antimony, crystals of antimony and the eutectic. As an anti-friction alloy should consist of hard grains which carry the load, embedded in a plastic matrix to give it the property of molding itself to the journal and its irregularities, without undue heating, and as such a condition is met with in alloys above 13% antimony (eutectic), those with 15 to 25% are the most suitable. It may be conceded, however, that in the alloy with 13%, while the friction is higher, the wear is greatly diminished, and where pressures are light this is a great advantage. Dr. Dudley, of the Pennsylvania Railway Co., has adopted the 13% alloy as the best all-round bearing metal for railway work. Lead is the best wear-resisting metal known, and with increasing antimony the wear is more marked, due to the splitting-up of the hard particles, but the friction becomes less and the temperature of running diminished. The harder the alloy the more difficulty there is of accommodating itself to a perfect bearing, and the greater the liability to heating. The compressive strength increases rapidly on the addition of antimony to lead, but varies little between 14 and 30% antimony, but afterward rises steadily. The compressive strength in the 14 to 30% alloy is nearly the same as that of the eutectic. Beyond this the crystals of antimony become more united and form a more continuous network; they then bear a portion of the load and the strength increases. But the crystals of antimony have no plasticity, and break when the load reaches a certain limit, and the alloy is reduced to fragments. Hence the necessity of having great strength and plasticity in the matrix, and this is better done with ternary than with binary alloys. Babbitt metal is a tin-antimony-copper alloy, consisting of tin 89%, antimony 7, copper 4. Tin-antimony alloys with 10 to 40% antimony, after freezing, give cubes of the compound antimony-tin whose proportion is greater the greater the antimony. They are less hard and brittle than pure antimony, and the soft metal which surrounds them appears not of a eutectic structure. Alloys of copper and tin containing 5 to 50% copper are composed of hard crystals of the compound $SnCu_3$, surrounded by a eutectic of tin and $SnCu_3$. The latter crystallizes in hard needles that stand out in relief after polishing.

WHAT IS AN ORE?

By James F. Kemp.

*The definition of a perfectly familiar word sometimes involves unexpected difficulties when we are confronted with the necessity of its expression in unmistakable language. The more familiar the object noted by it the greater is the surprise of one who finds himself obliged both to delimit from everything else and to put into other words the essential characters. Nothing is more familiar to the mining fraternity that the word 'ore.' So familiar is it that not every writer of a book on a mining subject has even thought of its definition, having obviously taken for granted the fact that everybody knows what ore is. There are nevertheless some striking differences to be found in the published works, and it may not be without interest to set the matter before the Canadian Institute and see what the impressions of its members are upon the subject.

The variation in the conceptions of ore largely rests upon the double use of the word both in a purely scientific and in a technical sense. Sometimes this contrast is not fully appreciated. It will doubtless be admitted by all that there is a group of metalliferous minerals that has been the source of the metals in mining and which as a class may therefore be set aside as 'ores.' Thus, if I have in my hand an ounce fragment of specular hematite, I may properly say it is an ore of iron. It is a well-known and important member of the group of minerals that has furnished iron to commerce. But if I show you a supposed mining property with only an ounce of specular hematite in it, and in this connection refer to it as ore, you would laugh scornfully. We must therefore carefully discriminate in our minds the connection in which the word is used. To this technical use I shall pass shortly, since it is the main point of interest, but I wish to clear away a few other preliminaries, relating to the use of the word 'ore' in other senses.

In the microscopic study of rocks we have learned that minerals crystallize from a molten magma in a fairly definite succession, and that the earliest group embraces magnetite, ilmenite, specular hematite, pyrrhotite, and one or two rarer metallic minerals, besides several non-metallics, such as apatite and titanite. We often denominate all these taken collectively the group of the 'ores', as contrasted with the ferromagnesian minerals; with the feldspars and feldspathoids; and with quartz. But we may set aside this use as not bearing in an important manner upon the question.

It is a time-honored conception of an ore, that it should consist of a metal in composition with some non-metallic substance, such as oxygen or sulphur, which disguises its metallic qualities and which is called a 'mineralizer.' Native metals are not 'ores' according to this view. The copper of Lake Superior is therefore obtained from 'copper-rock,' not from ore. Gold is yielded by 'gold-quartz,' not by gold ore. But I think we must all feel that this old-time usage is no longer sharply observed and that it may well enough drop out. Thus in T. A. Rickard's interesting little book on 'The Copper Mines of Lake Superior' we certainly find the output of the mines referred to as "ore."

Sometimes also in the mining of the non-metallic substance sulphur, the output of the mine is called 'sulphur-ore,' although no metal is involved at all. Yet, while we may not especially controvert this usage, it cannot be said seriously to affect the general and large conception of 'ore' as limited to the metalliferous minerals. Finally the word is used by Milton and other early English writers as meaning a metal itself, artificially produced; but, of course, this use of 'ore' is obsolete.

Let us now set in order the definitions which have been proposed and which treat of ore in its technical sense. We may then examine them somewhat critically and determine whether they satisfactorily formulate our present conceptions.

The most inclusive and sweeping of the definitions that I have found is one given by R. W. Raymond in 'A Glossary of Mining and Metallurgical Terms,' in Vol. IX of the Transactions of the American Institute of Mining Engineers, 1881.

"Ore. 1. A natural mineral compound of the elements of which one at least is a metal. The term is applied more loosely to all metalliferous rock, though it contain the metals in a free state, and occasionally to the compounds of non-metallic substances, as sulphur ore. 2. Corn.† Copper ore; tin-ore being spoken of in Cornwall as *tin*."

Obviously the above definition is open to grave objection. Thus, any mineral which contains a metal as one of its elements without regard to amount would be included. Hornblende with 5% iron would be an ore. Some other mineral with 0.5% iron or manganese would equally come within its provisions. To be at all satisfactory we must delimit far more sharply and upon some other basis. Yet from the associations in which the definition appears, one would anticipate a technical rather than a purely scientific expression.

William Humble, an English writer in a 'Dictionary of Geology and Mineralogy', etc., 1860, gives the following:

"Ore. (*erz* Germ.) A metallic compound. Metals are found usually combined with other substances; the compounds they thus form are called ores when the metal exists in them in sufficient quantities to form a considerable portion of the mass."

This definition introduces the idea of quantity, but not as yet in an altogether satisfactory way, the adjective "considerable" not being definite. At what point do percentages pass from considerable to inconsiderable? Is not 20% iron considerable, yet it would not warrant mining. Is 0.0008% considerable, and yet it might justify mining for gold. The word 'metallic' being sharply used in mineralogy for a variety of lustre, is also objectionable. We might question whether calamine, cerussite, siderite, and

*Read before the Canadian Mining Institute, Montreal, March 4, 1909. By courtesy of the author.

†Corn. i.e. Cornish.

many other well known ores would be included in the definition. Metalliferous is, of course, better.

Let us take now the two dictionaries which twenty years ago were chiefly cited in English-speaking North America. Worcester (1905 ed.) states: "Ore. 1. A mineral body which is reduced to the metallic state by fire; a metal chemically combined with some mineralizing substance which completely disguises its usually recognized and useful properties."

The first sentence of the definition is objectionable, since wet methods are no less serviceable than fire, in reducing the metals, and this delimitation for ore is obviously ill-chosen. The second sentence brings out the time-honored conception earlier discussed. It is flatly contradicted by Webster, whose definition will next be given.

"Ore. 1. The native form of a metal whether free or uncombined, as gold, copper, etc.; or combined, as iron, lead, etc. Usually the ores contain the metals combined with oxygen, sulphur, arsenic, etc. (called mineralizers). 2. (Mining.) A native metal or its compound with the rock in which it occurs, after it has been picked over to throw out what is worthless."

The first portion of this definition is so condensed in statement as to be literally meaningless. Thus as the word 'native' is used in connection with metals, it distinctively means uncombined. How then could the native form of a metal be "combined as (presumably 'in the case of' to be supplied) iron, lead, etc." We may infer that "native" means natural as opposed to artificial, but unless a reader knows more about the meaning of ore than good Noah Webster himself did, this definition will contribute little to clearness of thought. Curiously enough the second definition is scarcely better. Can a native metal be "compounded" with a rock? We usually employ in these senses compound to mean chemical union. Again, is the product of a mine never 'ore,' until it has been sorted over? Surely the majority of us would impose no such condition.

We come next to a series of definitions in which a distinction is made between the scientific use and the technical use and into which for the latter, the condition of profit is introduced as a feature, although it is not always insisted on as essential. The late J. D. Dana expresses his views as follows in his 'Manual of Mineralogy,' 1884:

"An ore in the mineralogical sense of the word is a mineral compound in which a metal is a prominent constituent. In the miners' use of the term, it is a mineral substance that yields by metallurgical treatment, a valuable metal, and especially when it profitably yields such a metal. In the former sense, galena, the common ore of lead, is, if it contains a little silver, an argentiferous lead ore; while in the latter, if there is silver enough to make its extraction profitable, it is a silver ore. Further than this, where a native metal, or other valuable metallic mineral, is distributed intimately through the gangue, the mineral and gangue together are often called the ore of the metal it produces.

The Century dictionary contains a definition, presumably by J. D. Whitney, which is essentially the same.

"Ore. 1. A metalliferous mineral or rock, especially one which is of sufficient value to be mined. A mixture of a native metal with rock or veinstone is not usually called ore, however; it being understood that in an ore proper the metal is in a mineralized condition—that is, exists in combination with some mineralizer, as sulphur or oxygen. The ore and veinstone together constitute the mass of the metalliferous deposit, vein or lode. The ore as mined is usually more or less mixed with veinstone and from this it is separated, as completely as may be convenient or possible, by dressing. It then usually goes to the smelter, who, by means of a more or less complicated series of operations, frees it from the worthless material, which still remains mechanically mixed with it, and also sets it free from its chemical combination with the substances by which it is mineralized."

The Standard dictionary, whose definition presumably passed under the eye of either W. H. Pettee or N. S. Shaler, is shaped along the same lines, as follows:

"Ore. A natural substance, sometimes forming part of a rock, containing one or more metals. The term is applied usually to a mineral from which the metal can be profitably extracted; but is sometimes extended also to non-metallic minerals, as sulphur ore."

In these three it is a little uncertain whether when Dana and Whitney say, with regard to profit, "especially," and when the Standard says "usually," they mean in the technical as contrasted with the scientific use or not. No one of them absolutely prescribes this condition, and a reader is somewhat uncertain whether it is essential or not. In definitions it is doubtless better to leave no ground for uncertainty or confusion of thought.

In Prime's translation of von Cotta's 'Treatise on Ore Deposits,' New York, 1870, we find the following: "Under the general term 'ores' are comprehended all minerals and mineral aggregates, which, from their metallic contents, attract the attention of the miner. 'Metalliferous deposits' are therefore for us all local accumulations of minerals or mineral aggregates which correspond to this demand. The idea of the terms 'ores' and 'metalliferous deposits,' in mining parlance, cannot be well expressed in a more precise and scientific manner. There is not any particular class of minerals or of rocks corresponding to these terms. To them belong native metals, metallic oxides, metallic sulphides, and even metallic salts, and their combinations; but on the other hand not all metalliferous species of the mineral kingdom, because many of these cannot, either from their nature or the too small percentage of the metal they contain, proportionally to its worth, be worked with profit. No rock, for example, containing 5% iron oxide can be considered an ore; while on the other hand, a vein of quartz, with but 1% gold would be regarded as a very rich and valuable metallic deposit, so relative is the idea. It is even possible, and has already occurred, that a mineral which for a

long time was useless to the miner, and on this account was not considered an ore, has, by means of new discoveries, been included in the category of ores. Blende, for example, when it did not contain valuable metals, could hardly have been considered formerly as an ore, though commonly defined as such; but since a method has been discovered of extracting zinc from it with profit, it may be ranked without doubt among the ores."

The idea or conditon of profit enters here, but it woud appear that the authors intended to define an ore according to the condition that the metalliferous deposit should attract the attention of the miner; that is, it should be a deposit out of which at the outset the miner thinks he can make a profit, whether the result justifies his expectation or not. There is a possibility in this of which I will make further mention in conclusion.

We now come to a group of definitions which clearly treat of ore in the technical sense, and which base the meaning upon the possibility of profitable extraction or treatment. In Murray's New English dictionary, 1905, the most comprehensive of its kind, we find:

"Ore. A native mineral containing a precious or useful metal in such quantity and in such chemical combination as to make its extraction profitable."

This definition is clear-cut and concise. We are reminded, however, that an ore is sometimes an aggregate of several minerals, any one of which perhaps if considered by itself would not be profitable, yet the sum total is. In the low-grade ores of the Boundary district, the little gold and the little silver that are present are important factors in the total, yet no one of the three metals alone in these percentages could constitute an ore. It would have been well to have added after native mineral the expression "or aggregate of minerals" to allow for such cases.

In the 'Universal Encyclopedia and Atlas,' published by the Appletons in 1901, the following definition by Thomas Egleston appears. It is taken from Johnson's Encyclopedia published twenty years earlier, and of which the Universal is the continued revision.

"Ore. A metal chemically combined or in the native state, mechanically mixed with other substances, which render treatment necessary to separate it. In a strictly technical sense, only those substances are ores which contain the metal in sufficient quantity and of sufficient purity to make the treatment profitable. Arsenopyrite, a combination of arsenic, sulphur, and iron, contains 34.4% iron, but it is not an ore of iron because the metal made from it is not of sufficient commercial value to pay the expense of treating it."

In the same volume the expression "ore deposits" is defined by R. Pumpelly and Charles Kirchhoff along the same lines, but a distinction is drawn between ore and gangue.

In other works of similar scope, like the 'New International Encyclopedia,' recently published by Dodd, Mead & Co., very much the same definition appears. "Ore deposits, the name applied to deposits or accumulations of metalliferous minerals or ores found in the earth's crust. The term ore includes those portions of the orebody in which the metallic minerals form a sufficiently large proportion to make their extraction profitable; aside from these, there are often quantities of associated non-metallic minerals forming masses containing little or no metal, which are termed the gangue."

Authors of books on mining are inclined to look with favor on the same line of attack. In the 'Manual of Mining' by M. C. Ihlseng and E. B. Wilson, New York, 1907, after a paragraph treating of the native metals we find:

"Ores. With the few exceptions (i. e., the native metals) the metals are found in chemical union with non-metallic substances, more or less completely segregated to constitute mineral. Any accumulation of mineral of good quality and in sufficient concentration to warrant the expenditure of energy for its extraction is an ore. Manifestly this is a fickle term, since it depends for its stability upon the casual conditions of the market as well as upon the mineralogical features." In a glossary at the close of the work, there appears: "Ore. A mineral of sufficient value (as to quality and quantity) which may be mined at a profit."

The short definition from the glossary is a little infelicitous in form, and a little sweeping in statement. It would, of course, include coal, asphalt, ozokerite, and other non-metallics, which the greater number of us would certainly hesitate to call 'ores'. The longer statement introduces the term 'mineral,' which deserves a word of comment. Aside from its general meaning, under which are included substances of inorganic origin as against organic, the word 'mineral' is used, in the United States at least, to designate in the large way the objects of mining, without special reference to profit or loss. Thus the law affecting the Public Lands recognizes "mineral claims," but either from a disinclination on the part of its framers to enter into the question of profit or loss, or else from a desire to embrace also possible non-metallic deposits, mineral is consistently used instead of ore. Thus C. H. Shamel states, in his valuable treatise on 'Mining, Mineralogical, and Geological Law,' New York, 1907:

"We may summarize the American law as to the legal definition and meaning of the word 'mineral,' when used in deed, leases, or other legal instruments, as including in the absence of special provisions in such instruments, all metallic minerals of sufficient value to justify mining and extracting the same, whether for the purpose of reducing the metal therefrom or some other industrial use. It also includes rock used for building materials, etc., coal, petroleum, and natural gas. Kaolin, brick-clay, slate, etc., have not been passed upon by the American courts; but on the authority of the English cases, and the decisions of the land departments hereinafter mentioned, the probabilities preponderate that the courts will hold them to be included under the term 'mineral', the same as granite, marble, etc."

In the paragraphs immediately following in the work cited, Shamel reviews the meaning of 'ore' in the few cases in which it has been defined by the

courts. The definitions are in the purely scientific rather than in the technical sense. The courts apparently prefer 'mineral' to 'ore,' wherever possible.

A definition very similar to the one from the glossary of Ihlseng and Wilson, is to be found in the 'Coal and Metal Miners' Pocketbook,' which is published by the International Correspondence School, of Scranton:

"Ore. A mineral of sufficient value (as to quantity and quality) to be mined at a profit."

As remarked above, this definition, of course, includes all manner of non-metallic minerals.

Several definitions from works on ore deposits will perhaps not be without interest. Thus in 'A Treatise on Ore Deposits,' by J. Arthur Phillips, revised by Henry Louis, 1896, we find:

"Metals which occur in a state of approximate purity are said to be 'native,' and when two or more such metals are found in combination the substance is called a 'native alloy.' Usually the metals sought after by the miner are, however, not found in the native state, but are mineralized by being united with various non-metallic bodies. In this way they combine with sulphur or chlorine, giving rise, respectively, to metallic sulphides or chlorides; with oxygen the metals form oxides, and with acids they yield salts, such as carbonates, sulphates, and phosphates. All natural combinations of a metal with such mineralizing substances are called ores when the proportion of metal which they contain, after suitable mechanical preparation, is sufficiently large to admit of their being advantageously treated by the metallurgist. Although perhaps not strictly correct, any material obtained by mining that contains a workable proportion of a metal is often called an ore, even if the whole of the metal be present in the native state."

This definition, perhaps unconsciously so far as its writer was concerned, contrasts the point of view of the metallurgist with that of the miner. But it is a contrast of which we shall need to take cognizance. Thus a miner might extract a quantity of metalliferous minerals from the ground at a loss. He might sell them to a metallurgist at such a price that the latter could profitably treat them. They might thus not be ore for the miner, although ore for the metallurgist. If you saw a pile of magnetite at a blast-furnace being successfully treated you would call it ore, even though it had been bought at the bankrupt sale of some miner.

In W. H. Weed's translation of Richard Beck's 'Lehre von den Erzlagerstaetten,' under the title, 'The Nature of Ore Deposits,' New York, 1895, we find the following:

"In a mineralogical sense an ore is a metalliferous mineral or a mixture of such minerals. Practically, however, this definition of an ore must be qualified by the statement that only those minerals and mixtures of minerals are ores from which metals or metallic compounds may be produced on a commercial scale and at a profit. Two examples of equal mineralogic or petrographic value may differ materially, a basalt carrying enough magnetite to influence the magnetic needle, but yet containing less than 10% iron, is far from being an iron ore. On the contrary, a vein with a silver content of only 0.5% is an ore deposit, since with this content it is commercially valuable. In the case of a gold deposit the amount sufficient to distinguish a gold ore from barren rock may be even less, for in California and Dakota gold ores with only 4 to 6 grains per ton of gold are exploited. Hence, it is the economic point of view that must always be borne in mind, the profit of working being subject to variation in the course of time. While nickel and cobalt were formerly nicknames for materials which were thrown upon mine dumps as useless, and were considered as a mere nuisance in silver mining, today the compounds of these metals and the associated minerals are in great demand as ores. To a certain degree a mineralized material may be an ore in one locality and yet not be an ore in another place, the cost of reduction depending on the proximity to lines of traffic and cheap freights. The science of ore deposits is, in other words, the study and consideration of the deposition, distribution, and origin of rock-bodies containing ores in such quantities that they may be extracted profitably by mining operations."

Heinrich Ries, in his 'Economic Geology of the United States,' New York, 1905, gives the following:

"The term 'ore deposits' is applied to concentrations of economically valuable metalliferous minerals found in the earth's crust, while under the term 'ore' are included those portions of the orebody of which the metallic minerals form a sufficiently large proportion to make their extraction profitable. A metalliferous mineral or rock might therefore not be an ore at the present day, but become so at a later date, because improved methods of treatment or other conditions rendered the extraction of its metallic contents profitable."

R. H. Stretch, in his hand-book on 'Prospecting, Locating, and Valuing Mines,' New York, 1903, writes in this way:

"An 'ore,' strictly speaking, is a single mineral which is a chemical compound of a useful metal and some other element or acid. In common usage, however, complex mixtures of pure minerals are considered as single ores; while free gold, native silver, and native copper, together with their accompanying gangue minerals, are also classed as ores. Among miners, whatever will pay to treat or ship and sell is considered ore, as also low-grade mineral which might be utilized by concentration or improved facilities; but there is an indefinite shading off into material containing traces of ore minerals but hopelessly unavailable, and this is not considered ore; neither are gold gravel or platinum sands called ore. To avoid misunderstanding it is best to distinguish between the 'ore' (meaning thereby the whole bulk of the available product) and the 'ore mineral' (usually very much smaller in quantity in all ores except those of iron, manganese, and some lead and zinc ores)."

Probably with search a few other definitions might be found, but without adding anything essentially new or important. I think that we must conclude that a distinction should be drawn between the

purely scientific use of the word and the technical. Not every metalliferous mineral is an ore even in the former sense. Many can be cited which it would be ridiculous to call by this name. Nor can a metalliferous mineral be called an ore unless at some time it has proved to be a practicable source of some metal. Once successfully used it establishes its standing and joins the group of the ores. This differs from Dana's definition that in an ore a metal should be a prominent constituent, since a species of amphibole might have 5 or 10% iron, iron being thus a prominent constituent, and yet not be an ore.

I suggest the following: In the scientific sense an 'ore' is a metalliferous mineral belonging to the group of those which have profitably yielded the metals to the miner or metallurgist. In its technical sense an ore is a metalliferous mineral or an aggregate of metalliferous minerals, more or less mixed with gangue, and capable of being, from the standpoint of the miner, won at a profit; or from the standpoint of the metallurgist, treated at a profit.

The test of yielding the metal or metals at a profit seems to me in the last analysis to be the only feasible one to employ. In a new enterprise, as we all know, it is customary to refer to the mineral in the ground as 'ore,' before it is proved to be such by profitable operation. If the enterprise should subsequently prove unsuccessful, it would only remain for those engaged in it to say that they thought they had ore, but that they had made a mistake. As soon as a shifting or variable standard is introduced, such as individual beliefs or expectations, such uncertain, changeable, and, on the whole, unsatisfactory conditions are developed that a sharp definition upon a secure and unmistakable basis becomes an impossibility. On the other hand, the test of profit certainly meets the requirement: "Use is the law of language."

A silicon-calcium-aluminum alloy is being introduced in this country by C. W. Leavitt & Co., of New York, the analysis being approximately silicon 47 to 57%, calcium 15 to 25, aluminum 2½ to 6½. The chief applications of the alloy are as an energetic deoxidizer and for securing a better desulphurization. It contains the two elements most useful for the deoxidation of a metal (silicon and aluminum), and also calcium, which is an energetic reagent. Added into the ladle it calms the steel and enables the tapping of sound ingots. The products of the reaction of this alloy are double silicates of calcium and aluminum, which have a low melting point, the slag rising to the surface of the steel. This alloy is said to give better results than aluminum alone, even when added in the ingot mold itself, because it forms an easily fusible slag which disengages from the steel. The alloy may be introduced either into the furnace a short time before tapping, or into the tap-hole during the tapping, or into the ingot mold instead of aluminum, or together with aluminum.

Only on steady load does a chimney give full efficiency, whereas fan-draft can be controlled to suit the requirements of the moment, and forced in case of emergency.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

M. L., San Francisco.—No. 1, basic andesite or basalt; No. 2, leached and kaolinized rhyolite or rhyolite tuff; No. 3, quartzite; No. 4, altered and weathered rhyolitic rock; No. 5, kaolin with limonite and (sulphate of iron?); No. 6, kaolin with limonite and small amount of free silica; No. 7, fine grained quartz aggregate; No. 8, rhyolitic breccia; No. 9, leached and weathered rhyolite or rhyolite tuff; No. 10, rhyolite slightly impregnated with pyrite and calcite; No. 11, rhyolite tuff badly weathered; No. 12, extremely weathered rhyolite tuff impregnated with pyrite; No. 13a, quartz with pyrite and epidote; No. 13b, too small (obsidian?).

S. E. M., Quartzsite, Arizona.—No. 1, epidotized granite or quartz diorite; No. 2, chlorite schist; No. 3, chlorite schist; No. 4, epidote with incrustations of calcite; No. 5, metamorphosed andesite; No. 6, quartz-mica schist; No. 7, quartz-chlorite schist; No. 8, tourmaline in quartz.

Estimation of iron and vanadium in the presence of each other may be made as follows: if a solution containing both Fe and V be reduced by SO_2 the V is reduced to V_2O_4, Fe to FeO. Titration with permanganate oxidizes the V to V_2O_5, FeO to Fe_2O_3. If the same solution be passed through a reductor and received in a solution of $Fe_2(SO_4)_3$ the V is reduced to V_2O_2, the Fe being again brought to FeO. The reducing power of the V_2O_2 is transferred to the Fe_2O_3 of the receiving solution, and now titration with permanganate shows the increased reduction due to V_2O_2 in the latter case, against that due to V_2O_4 in the former. This difference can be calculated to V. The other portion of the permanganate used has been destroyed by the FeO, which may be calculated accordingly.

The village of Kilmore, in County Galway, Ireland, has been engulfed by the great sliding bog of Kilmore, most of the cottages having been covered up to the roofs. About one seventh of Ireland is covered with bogs, that of Allen alone comprising 370 square miles, with an average depth of 25 feet. The method by which a bog invades its neighborhood is singular. Originally it will have been a lake, around the shores of which vegetation has grown outward, both at the surface and on the bottom. Eventually the vegetation on the surface forms a strongly matted layer, beneath which lie the muddy waters of the lake. Heavy rains then augment this intermediate watery layer until the centre swells up, the skin of vegetation bursts, and a deluge of black mud pours out into the surrounding country.

In determining the calorific value of peat it is better to make direct determinations in a calorimeter than to rely on Dulong's formula, as determinations by his formula invariably give results 6 to 10% too low.

USES OF ALUMINUM.

By J. T. W. Echevarri.

*Aluminum is obtained electrolytically from bauxite, cryolite being used as a flux. Most of the metal turned out today carries close upon 99½% of aluminum, while metal with as little as 0.4 to 0.3% impurity is obtainable for special purposes. The impurities commonly found in aluminum are iron, silicon, and sodium. Silicon renders aluminum brittle if present in large quantities. It also impairs the resistance to corrosion peculiar to pure aluminum. The thin yellow coating which forms on the inside of aluminum cooking utensils is largely composed of silica. The percentage of silicon should in no case exceed 0.4 to 0.5%, although the metal as used in iron and steel works may contain double this amount.

Iron occurs in high-grade aluminum to the extent of about 0.2 to 0.3%, and while impairing the ductility in the same way as silicon, the tensile strength is somewhat improved by its presence in small quantities. Iron does not appear to affect the electric conductivity of aluminum to the same extent as silicon, but has a bad influence on its non-corroding properties. Sodium is the most injurious impurity, as the resistance to corrosion is seriously lowered by even small quantities of this metal. Improved methods of manufacture have, however, eliminated all but the minutest traces of this element, till today more than 0.006% sodium is rarely found.

The pure aluminum of commerce is a silver white metal, with a melting point of 657° C., and a specific gravity ranging from 2.56 to 2.72, according to its method of treatment. Copper having a specific gravity of about 8.8, zinc about 6.9, and tin about 7.3, it follows that aluminum is about 3.3 times as light as copper, 2.5 times as light as zinc, and 2.7 times as light as tin. The heat-conductivity of aluminum is high, being second only to copper among the common metals. Its electrical conductivity is also high, being from 60 to 62% of that of pure electrolytic copper; it having, like copper, a somewhat lower resistance when soft than when hard drawn.

The strength of pure aluminum depends to a large extent on its methods of treatment, but the following table gives average figures for the metal in various forms in pounds per square inch:

	Ultimate tensile strength.	Yield point.	Elongation, %.	Modulus of elasticity.
Sand castings	10,000	5,000	25	
Chill castings	10,500	5,000	35	
Rolled bars	14,000	10,000	35	
Rolled sheet	18,000	16,000	6	
Drawn section	17,500	16,000	20	
Hard-drawn wire..	30,000	26,000	25	9,000,000
Soft-drawn wire...	14,000	8,000	30	10,000,000

Aluminum may be melted in ordinary plumbago crucibles, but where quantities are to be melted a reverberatory furnace is generally used. It should not be heated above 725° C., to avoid 'burning'. At that temperature aluminum readily oxidizes. Sheet can be re-melted by submerging in the molten metal, the loss being only from 2 to 3%, which is much lower than in the case of brass and similar metals.

Aluminum can be cast in either sand or chill molds, the latter method being generally employed where a good finish is required. Aluminum cast in polished steel molds has a finish equal to the best machined surface. For rolling it is cast into large slabs or blocks, which are afterward broken down hot, the intermediate and finishing stages being done cold, the amount of annealing being governed by the temper and finish required. Where an extra finish is required, as for photographic and lithographic work, great care is necessary in preparing the finished plate. Where a dead or roughened surface is required on the finished sheets, as for painting, decorating, and varnishing, they are dipped in a 10% solution of caustic soda for a few minutes, and afterward washed in clean running water. To obtain a satin finish, as required for printing, the sheets are passed under a rapidly revolving scratch-brush.

Aluminum can be easily drawn into sections, tubes, and wires, the same methods being employed as for copper. The billet is first rolled down hot to a convenient size, and afterward reduced to the correct section on the draw-bench, cold fat being used as a lubricant. For drawing down to the finer gauges in wire-drawing machines, paraffin is employed as a lubricant. The amount of annealing during the process depends upon the temper required. Wires from ¾ in. down to 0.018 in. diam. can be drawn in this manner, these being used for practically all purposes where copper, brass, or german silver wire is used. Sections, rods, and tubes can be made by forcing the solid metal, at a temperature of about 80° C., by hydraulic pressure, through suitable dies. Soft aluminum sheets can be spun, stamped, or pressed into various shapes, cocoa-nut oil or other lubricant being used. For turning, a sharp-edged tool with a good clearance should be used, and the work run at high speed, combined with a slow traverse, plenty of lubricant in the shape of soap and water or paraffin being applied. For drilling holes a diamond or nose-drill, with ample clearance, should be employed, a twist-drill being liable to 'seize'. Screw-threads can be cut with an ordinary tap, using a little light oil as a lubricant.

Aluminum can be soldered by means of various solders now on the market, but as soldered joints are all subject to electrolytic action in the presence of moisture, they are only suitable when protected from damp air. Welded joints, being entirely of aluminum, do not suffer under these conditions, and this method is being more extensively adopted, now that satisfactory welded joints can be made by means of portable oxy-acetylene blow-pipe equipments. It had long been recognized that this was the most hopeful direction in which to experiment, because such joints, containing as they do nothing but aluminum, would be as free from electrolytic action as the metal itself, but the difficulty met was in getting rid of the film of oxide, which prevented the two surfaces uniting properly. In the case of butt-welding of small rods and wires, this difficulty can be overcome by applying end pressure at the moment of fusion to drive out the film of oxide, but in the case of sheets and

*Abstract from paper read before the Institute of Metals, England.

plates the method is not practicable. Several fluxes have been put on the market capable of dissolving the film of oxide and permitting the metal to flow together with perfect ease. Another method of welding aluminum sheeting, which would repay further investigation, is the electric system, by so-called spot-welders.

Aluminum is used in iron and steel works for removing the oxygen from the oxides of iron, and other substances, with which it comes in contact, the heat generated by this reaction being so great that it may also be of service in raising the temperature of large bodies of iron. The efficacy of small quantities of aluminum in preventing 'porosity' is also marked. Porosity is due to the partial disengagement of gases absorbed during melting which are imprisoned as the metal cools. Aluminum has the property of combining with these gases to produce a slag. It frequently happens that a casting requires two 'blows' of the cupola. In this case the difficulty of keeping the first tapping hot while the second charge is running down may be overcome by adding from time to time small quantities of aluminum to the metal in the ladle. For the purpose described, the metal may be employed in various forms. An alloy known as ferro-aluminum, consisting of about 90% iron and 10% aluminum, is employed by many iron and steel founders. The use of ferro-aluminum has, however, been largely superseded by that of the pure metal. Some steel makers use aluminum in a form known as 'granulated', varying in size of grain from that of rice down to that of sifted sugar.

A further application of this principle has been made in the 'thermit' welding process invented by Goldschmitt, where the heat of combustion of aluminum and oxygen is made use of to raise the temperature of iron and steel castings to the welding point. For welding tramway-rails and the like, the two parts to be joined, after being carefully cleaned, are firmly fixed, leaving about ¾ in. between them. A sand mold is then formed round the joint, in such a form that the section at the joint after the molten metal has been run in would be somewhat larger than the normal section of the rail. This mold is then heated by means of a powerful blow-lamp to a dull red heat, and the molten iron produced by the 'thermit' reaction is then run in from the funnel-shaped crucible in which the reaction has taken place. After the joint has cooled the mold is removed. Joints made in this manner have been subjected to both tensile and bending tests, and are found to be fully equal to the rest of the rail.

For castings, it is found of advantage to alloy the metal with copper, zinc, or nickel, which increases the strength and makes it easier to work, without materially increasing the weight. Standard light-weight alloys with the following characteristics are regularly made: (a) Specific gravity, 2.7; tensile strength, 14,000 to 18,000 lb. per square inch; elongation, 5 to 10%. This alloy makes castings which will afterward rivet or take a set, so that it is an admirable substitute for soft brass. Being soft and tough, it can be easily forged, stamped, or drawn, such working increasing its tensile strength up to as much as 36,000 lb. per square inch. (b) Specific gravity, 2.9; tensile strength, 18,000 to 22,000 lb. per square inch; elongation, 2 to 5%. This alloy is designed to give specially clean castings, easily machined, able to take and retain a high polish. (c) Specific gravity, 3.1; tensile strength, 22,000 to 26,000 lb. per square inch; elongation, 2 to 4%. This is also a casting alloy, but considerably harder than the foregoing, and makes a rigid strong casting which will take and hold a set-pin. It is a splendid metal for machining, and takes and retains a fine finish. The yield point under compression is also high, being about equal to its ultimate breaking strength in tension.

When rolled into sheet, the uses of aluminum are too numerous to mention, as the light metal is every day coming into stronger competition with older metals. Aluminum, being, next to gold, the most malleable of all the metals, it can be spun, stamped, pressed, or worked under the hammer into every imaginable shape, and its uses in connection with the manufacture of articles of everyday use are unlimited. Another point in favor of aluminum is that the metal takes and retains a high polish. It has for some years past been used almost exclusively in place of silvered copper for parabolic reflectors in motor headlights.

Wall 'paper' and ceiling-panels made of thin embossed sheet is a refinement of modern art, the use of which is likely to become more general now that the price has been reduced, as such a covering is not only fire-proof, but can be washed, and is more durable than ordinary wall-paper. Aluminum sheets of special finish have for many years been largely used for lithographic purposes, and are gradually but surely replacing lithographic stones and zinc plates. Aluminum sheets are also largely used for the panels of car and carriage bodies, as well as for tram-cars and electric trains. The saving in dead weight is of considerable importance, especially in the case of electrically driven trains, subject to frequent stops and starts, as the power required for acceleration is in direct proportion to the weight to be moved.

In the early days of the aluminum industry, sheets composed of copper alloys were used to some extent in shipbuilding. It has, however, been demonstrated that pure aluminum of the best quality should be used, and there is little doubt that naval constructors will find pure aluminum sheets, channels, moldings, rivets, and so forth, of great assistance in partitions, ceilings, deck and chart-houses, and similar portions of large ships above the water-line, where reduction of top-weight is of importance in connection with the stability of the vessel.

The advantages of aluminum for culinary purposes are universally known; its durability and absolutely non-poisonous qualities being among its chief recommendations. Aluminum powder is being used to an increasing extent in the manufacture of metallic paints and varnishes, its non-tarnishing qualities making it particularly suitable. Aluminum paint is used extensively for protecting iron and wood-work, rendering the latter to a certain extent fireproof if a thick coating be applied. For printing purposes alu-

minum paint and leaf is also supplanting silver, as it is found to adhere better to the paper. Thin aluminum foil is also used largely for packing, in place of lead or tin, its non-poisonous properties making it particularly desirable. Large quantities of specially pure aluminum tubes are used for various purposes in acid work, under which condition the pure metal remains practically unaffected. In order to demonstrate the usefulness of aluminum tubes for steam coils, some tests were made at Milton some time ago, with the following results:

Length of tube, in.	Gauge.	Outside diameter, in.	Tested to lb. per sq. in.	Remarks.
12	10	3¼	1200	Expanded to 1/32 in. in middle, but returned to original size on release of pressure.
12	12	2 11/16	1200	Ditto (barely 1/32 in.).
12	14	2	1200	As above, with rather less expansion.
12	14	1⅛	1200	Perfect. Would probably stand considerably more.
12	19	1⅛	1200	Ditto.

All the above were afterward tested at 100 lb. per square inch for half-an-hour, with the exception of the second, which was under the steam-test for 12 hours without apparent injury. This tube was, after the steam test, subjected to a second test of 1200 lb. hydraulic pressure, and showed no signs of fracture. The sample piece of tubing exhibited has been cut from a 12-ft. length which was coupled to an iron steam-supply system, by means of iron clamps, and after being in use for five or six years reveals no sign of deterioration. There also appears to be a field for aluminum for galvanizing purposes, by introducing small quantities of the metal into the bath, rendering it more fluid, enabling a larger surface to be galvanized with a given quantity of zinc, and producing a brighter finish than is otherwise obtainable. As a conductor of electricity, aluminum has a large field of usefulness. The saving that can be effected by using aluminum in place of copper for overhead conductors is so large that in countries where long overhead transmission lines are in vogue the lighter metal practically reigns supreme. In England there has not been up to the present the same opportunity for long-distance bare overhead transmission lines, but during the past few years many short-distance aluminum lines have been erected for lighting and power. Aluminum as used for electrical purposes has a conductivity equal to about 61% of that of pure electrolytic copper, so that to obtain the same conducticity it is necessary to increase the sectional area by 64%, corresponding to an increase in diameter of 28% for a round conductor. Copper being 3.3 times heavier than aluminum, the somewhat larger aluminum conductor will weigh less than half of the equivalent copper conductor, the larger cooling surface of the aluminum conductor being a further factor in its favor. For small diameter wires, as used for making up into cable, the usual butt-welded joint is made either in the flame of a blow-lamp, or by means of electric welders, as used for copper. For bare-stranded cables the usual method is to weld the two ends together by pouring molten aluminum into a cigar-shaped mold, previously clamped around the joint, but where high tensile strength is required a mechanical joint may be used, so designed as to give a wedging action when pulling tight, in order to ensure good electrical contact. The tensile strength of hard-drawn aluminum wire is equal to about half that of copper wire of equal section, but allowing for the increased size of an aluminum conductor to obtain the same conductivity as for copper, this figure is raised to about 75%, the difference being more than compensated by the decreased weight of the aluminum cable.

Tungsten may be separated from silica by the following method, proposed by Bourion: A weighed amount of the sample is placed in a porcelain boat, which is inserted in a combustion tube, and the boat is strongly heated in a current of Cl, containing a little S_2Cl_3. It is volatilized as chloride or oxychloride, which is caught in water placed in the receiver. SiO_2 remains in the boat, and may be weighed after washing and igniting. The contents of the receiver, together with ammoniacal rinsings from the tube, are evaporated with HNO_3, H_2SO_4 expelled by heating, and after treatment with NH_4NO_3 the WO_3 is ignited and weighed. Defacz recommends a similar process. The material is treated in a boat within a combustion tube, first in an atmosphere of H to reduce the W, afterward in a current of Cl to volatilize the W and leave the SiO_2.

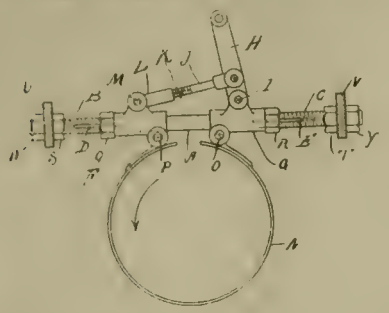
What are designated as 'low-resistance pyrometers' have, during the last few years, come widely into use. They are the logical outcome of the discovery that, while thermo-couples of certain alloys of base metals will not maintain their e.m.f., and, in some cases, not even withstand the physical and chemical assault of the very high heats that the platinum-rhodium couples will meet, they will, nevertheless, withstand the more moderate heats when such base metal couples are constructed with elements of large cross-section.

The melting point of iron which has been commonly accepted is nearly 100° C. too high for the melting point of pure iron, as shown by figures given by H. Carpenter in *Metallurgie*, November 22. He gives as the melting point of pure iron 1505° as measured by the Le Chetelier pyrometer and 1491 to 1519° for the optical scale. The freezing point is independent of the gas in contact with the metal, a fact difficult to explain when we know that oxide of iron is quite readily dissolved by the molten iron.

Willemite as a commercially important mineral of zinc ores is mined at Tres Hermanas in southern New Mexico. The mineral forms dense masses consisting of slender hexagonal prisms, and is associated with calcite, a little smithsonite, and calamine, as well as hydro-zincite. The occurrence is in the oxidized portion of a contact metamorphic deposit in limestone at a contact with quartz-porphyry. A number of carloads of this mineral were shipped in 1905. The mineral was identified by analysis.—W. Lindgren.

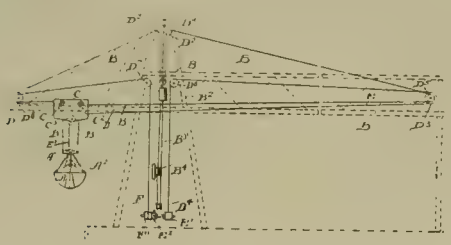
MINING AND METALLURGICAL PATENTS.

DOUBLE-ACTING BAND-BRAKE.—No. 910,435. Don N. Thompson, Owego, New York.



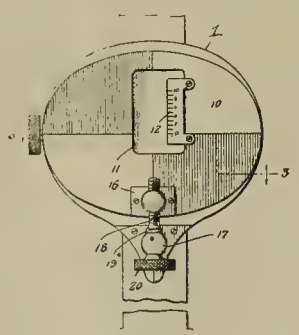
In a double acting band brake, a rod the two ends of which have threads and key slots cut therein, two sliding blocks adjustably secured on said rod, stop nuts threaded on the opposite ends of the rod for adjusting said sliding blocks, an applying lever one end of which is pivotally secured to one end of said sliding blocks, a sleeve pivotally secured to the opposite sliding block, a forked rod one end of which is threaded in said sleeve, the opposite end being secured to the applying lever, a band adapted to pass around a drum on one end of said band being secured to the under side of the inner end of one of the sliding blocks, the opposite end being secured to the under side of the inner end of the opposite sliding block, and nuts for securing the rod to the supports.

HOISTING APPARATUS.—No. 913,020. Frederick W. Lovell, Cleveland, Ohio.



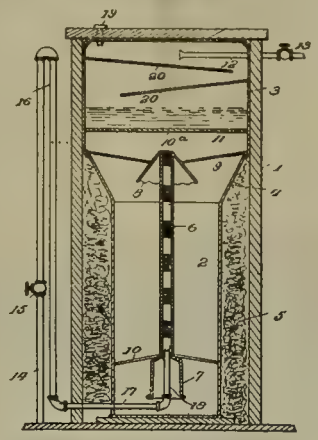
Hoisting apparatus comprising a bridge, trolley carriage, and an automatic bucket having a holding rope and a hoisting and trolleying rope, and means for automatically taking up slack in the holding rope, the operation of said means being independent of the lateral trolleying movement of the bucket.

SURVEYOR'S TARGET.—No. 913,069. Grant T. Stephenson, Wells, Michigan.



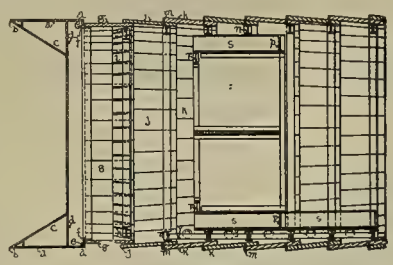
A surveyor's target comprising an inner plate adapted to be fixed to a staff, an outer plate movable in guides over the face of the inner plate and of approximately the same size, members extending laterally from the respective plates and having registering bores the bore of the movable plate member being screw threaded and that of the next member unthreaded, a fine threaded micrometer screw having an unthreaded portion rotatable in the bore of the fixed member with its threaded portion engaging the screw threaded bore of the movable plate member and means for holding said screw against longitudinal movement.

MEANS FOR EXPANDING COMPRESSED AIR.—No. 912,647. Robert S. Cates, Kingman, Kansas.



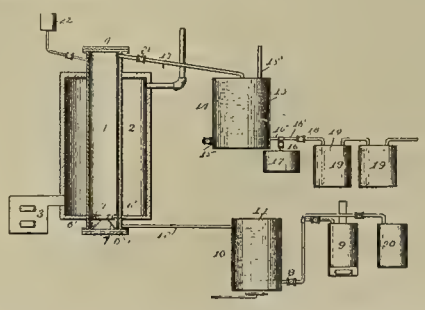
In refrigerating apparatus, the combination of a chamber having its lower portion contracted and its upper portion enlarged and adapted to receive a liquid refrigerant, an air expansion pipe located in the contracted portion of the chamber and immersed in the liquid refrigerant contained therein and open at its top and bottom, means for supplying compressed air to the lower portion of the air expansion pipe to cause the air and liquid to pass through said air expansion pipe in alternate separated portions, and a partition arranged in the upper enlarged portion of the said chamber to effect separation of the air when expanded from the refrigerant.

TUNNEL-BORING DEVICE.—No. 912,575. Reginald H. Keays, New York.



In a structure of the class described, the combination with permanently-positioned tunnel-members of a shield; a jack-frame independent thereof and supported by said tunnel-members; and forcing devices mounted in said jack-frame and interposed between said shield and said jack-frame.

METALLURGICAL PROCESS.—No. 913,535. George Moore, New York.

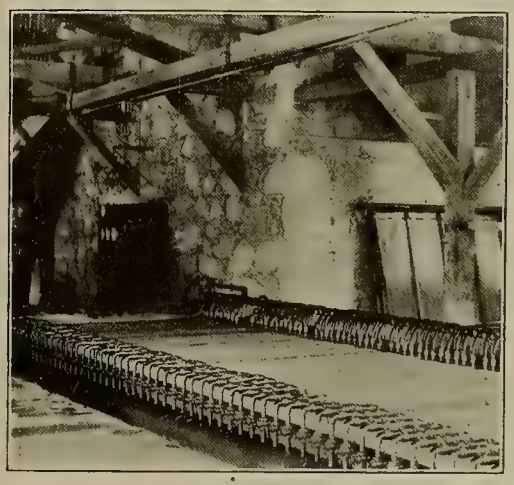


The process of separating metals from their ores, consisting in volatilizing salts of the metal in a suitable vessel, forcing steam upwardly through the subjected ores, and condensing the impregnated steam.

Filter Plants at Pachuca.

Written for the MINING AND SCIENTIFIC PRESS
By C. G. PATTERSON.

The Loreto plant, at Pachuca, Mexico, has 104 Butters filter-leaves, and uses an 8-in. Butters pump. The plant was designed in July, 1907; it was completed and started in operation the middle of January, 1908. The plant was designed for two units, or boxes, each box to contain 104 filter-frames with a rated capacity of 200 tons of dry slime for each unit. Shortly after the first box was put in operation, 4 tube-mills were added to the crushing plant, which gave a finer product and a greatly increased tonnage. The following is a copy from the filter log-book of February 12, thirteen months after the plant was started, and is a fair average of regular performance.



Butters Filter in Loreto Mill, at Pachuca.

Sizing-test of pulp, plus 150 mesh 3½%, plus 200 mesh 4$^{1}/_{10}$, minus 200 mesh 92. The day's run consisted of 6 charges from the treatment-tanks, as follows:

Tank No.	Charge No.	Sp. gr.	Dry tons filtered.
23	187	1.41	61.73
30	189	1.41	50.89
28	191	1.42	68.90
27	192	1.37	50.56
10	193	1.41	59.49
3	195	1.45	61.62
Total tonnage, 24 hr.			353.17

The tonnage was handled in 16 charges, making the average time of each cycle 1 hr. 30 min. In 14 of the cycles 100 filter-leaves were in use, and in two cycles 99 leaves. The average thickness of cake formed was 1 in., and the time of forming these was 30 min. in each cycle. Of course, by crowding the filter so much beyond its rated capacity, there was only time for 15 min. water-wash, which is not sufficient to make a complete recovery of the dissolved gold. With this rapid work a saving of 40c. per ton net more than would be possible without the filter was accomplished. The power consumed by the 8-in. Butters pump, vacuum pump, and agitator in the stock pulp-tank was 675 hp.-hr., or 1.9 hp.-hr. per ton of dry slime treated. The leaves are in good condition. An addition of 200 filter-leaves is being made, 100 for the second unit of the Loreto plant and 100 for the second unit of the Guerrero plant.

The Guerrero plant is at Real del Monte, about 9 miles from Pachuca. The plant was designed in August 1907, and was completed and put in use November 1908. It has 96 filter-leaves and is on the semi-gravity system, the box filling by gravity through 10-in. pipe-lines, and the excesses returned through the same pipes by an 8-in. Butters pump. Their log-book of January 30 presents a good average of the work done. Specific gravity of pulp 1.3, 90% passing a 200-mesh screen. The cake formed is 1 in. in 30 min. The complete cycle of operations takes 1 hr., 30 min., time of wash 30 to 35 min. Owing to the semi-gravity system, the time of transfer is shorter than in the pumping system. This plant was also designed for a second unit, it only being necessary to add the extra box and leaves. At present it is a good example of simplicity and efficiency. Both plants, when doubled, will be operated with the same amount of labor as at present. It may be noted that the 600-ton plant of the Goldfield Consolidated Co. requires no more labor than the 70-ton plant at the Combination mill.

Commercial Paragraphs.

E. C. GRICE and E. M. BUSS have established a metallurgical laboratory at Boise, Idaho, having organized the Boise Laboratories Company.

THE AMERICAN DRAFTING FURNITURE CO., Rochester, New York, announces that its new loose leaf catalogue will be ready for distribution soon.

The CUTLER-HAMMER MFG. CO., Milwaukee, announces the opening of a district office in Cleveland, Ohio—1108 Schofield Bdg.—in charge of C. J. Kruse.

The BYRON JACKSON IRON WORKS, West Berkeley, Cal., has recently furnished a two-stage deep well turbine pump for the Illinois Eastern Hospital for the Insane at Kankakee, Illinois.

THE D. D. DEMAREST CO., San Francisco, advises that it has recently received a 'repeat' order for Pacific Lubricating Stopcocks from the management of the North Star mine at Grass Valley.

THE A. S. CAMERON STEAM PUMP WORKS, New York, has lately published a wall map showing the route and profile of the Panama Canal. A smaller scale map shows the distances from the world's principal ports to the termini of the canal.

THE AMERICAN GRÖNDAL KJELLIN CO., New York, announces that a testing plant for the concentration of iron ores according to the Gröndal system has been opened at Sheridan, Pennsylvania, where ores will be received and tested free of charge.

The KROGH PUMP CO., San Francisco, advises us that it has recently sold two 4-stage turbine pumps to the city of Oakland for a new high-pressure fire system. Also a large dredging pump has lately been shipped to the city of Seattle for use in sewer construction.

The HENDRIE & BOLTHOFF MFG. & SUP. CO., Denver, in its March letter announces the fact that it has secured the exclusive manufacture and sale of the Bunker Hill screen. This is a wet screening device, developed and perfected in the mill of the Bunker Hill & Sullivan Mining Co. at Wardner, Idaho. The screen has been tested and is now ready for the market.

THE VULCAN IRON WORKS, Seattle, Washington, has under construction new buildings for a complete plant. The principal building will be a supply and jobbing house 100 by 270 ft., seven stories high. Seven other buildings will bring the total floor space up to over 250,000 sq. ft. Catalogues and literature descriptive of steel-concrete buildings, modern foundry equipment, machine shop tools, and the like will be welcomed by the company.

Catalogues Received.

THE ORE DRESSING MACHINERY CO., New York, is distributing a pamphlet describing the Hennig concentrating table.

CHALMERS & WILLIAMS, Chicago, in their Catalogue No. 1, Section L, describe the Kennedy gyratory crusher and discusses its advantages.

THE WELLMAN-SEAVER-MORGAN CO., Cleveland, Ohio, has just issued a new bucket circular describing with photographs, drawings, and printed matter its extensive line of buskets for handling ore, coal, crushed stone, cinders, and so forth.

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EDITORIAL.

A BILL for a Bureau of Mines has been introduced into the House of Representatives by Mr. Coudery of Missouri. It is doubtful whether it will come to vote at the present special session of Congress.

TWELVE States and Territories have appropriated sums ranging from $15,000 to $400,000 each for exhibits at the Alaska-Yukon-Pacific Exposition at Seattle. Six other States have bills pending before their legislatures, providing sums of money for the same purpose. A fine mineral display is promised.

CONTINGENT FEES formed the subject of discussion at a recent meeting of the New York section of the Mining and Metallurgical Society of America. We publish the opinions expressed on that occasion, believing that the matter is of general professional interest. Whatever the views held or expressed by mining engineers, it is well to clarify our conceptions of right and wrong in matters that touch the fundamentals of professional honor. We shall not all agree upon any hard and fast rule, but we can assert the principles that guide right conduct and thus, by creating a healthy public opinion, stiffen the moral backbone of the mining profession.

RESIDENCE in a foreign country modifies the point of view, by enlarging it; therefore, when an American mining engineer returns from South Africa, he is able to make interesting comment on technical practices in his home country. In this issue we publish such comment from Mr. T. Lane Carter, an American from south of Mason & Dixon's line who has lived in the Transvaal for ten years. For several years he acted as the Johannesburg correspondent of this journal, while in charge of important mines in that region. He has recently visited the chief mining centres of America and, at our request, he has contributed criticisms which are suggestive.

FROM GOLDFIELD comes the gratifying news that Mr. J. H. Mackenzie and Mr. E. Hampton have opened up a new, large, and rich orebody in the Combination ground of the Goldfield Consolidated Mines Company. This orebody is in territory that is virgin, with a chance of further development in an area fully 700 feet long. The ore has been cut on the fourth, fifth, and sixth levels, and within 14 days has yielded $300,000 from material broken in exploratory workings. We are informed that the indicated ore, that is, ore likely to be developed, is estimated at $4,000,000. The lode has a maximum width of 30 feet, and contains a streak assaying $30 per pound.

so that an average of $100 per ton is not surprising. But it is surprising that the information should be given weeks after the event, at the close of a period during which bear tips have been circulated. Should the discovery prove to be all that is expected there will be a rise in the quotations, enabling those who recognize the inflated capitalization of Goldfield Consolidated to sell to others more speculatively inclined. More money is lost in over-capitalized and over-estimated rich mines than in worthless holes-in-the-ground. The Consolidated of Goldfield is a great mine and we hope it may, under its experienced superintendency, continue to develop. But until the directorate publishes proper monthly and annual reports, acting like trustees rather than privileged speculators, this splendid enterprise will remain only a colossal gamble.

COPPER will soon be produced on a large scale by the Braden Copper Company in Chile. The mine was developed under the guidance of Mr. William Braden, and subsequently examined by Mr. Allen H. Rogers at the instance of Mr. A. C. Beatty. As a result of the favorable report which Mr. Rogers returned, coupled with demonstrations of the low price at which the ore can be mined and smelted, the Guggenheims have issued $4,500,000 in bonds to finance the property, the bonds being promptly over-subscribed. A narrow-gauge railroad will be built from Rancagua on the National line, in the Province of O'Higgins, to the mine, a distance of 45 miles. It is considered certain that copper from the Braden mine can be delivered at New York or European ports for less than 8 cents per pound.

A CORRESPONDENT asks what is a mineralizer? The dictionaries gravely inform us that it is a substance that mineralizes, or converts a metal into a mineral or ore. The term has been employed usually with an eye upon economic considerations, although geologists also speak of the substances promoting the formation of minerals in a magma as mineralizers. Such use of the word seems open to objection. The popular conception must rule, for once a term has passed into common speech its employment with any other meaning only defeats the ends of accuracy. Mineralizer has come to signify a chemical agent resulting in alterations of rocks with the introduction of metals or metallic compounds. Hence its tendency is, as the lexicographers indicate, to produce what will become an ore if the metallic content be high enough to admit of economic extraction. The word has regard to the function rather than the substance; any agent serving to effect alterations and new combinations, leading to the formation of metalliferous deposits, is a mineralizer because of the office it has performed. Limited to that meaning, which is undoubtedly the idea that the expression conveys to the average man, no uncertainty can follow its use.

VIEWS expressed by the chairman of a London trust company have emphasized the relative lowering of British credit as measured by the depreciation of capital invested in British territory. Consols compare favorably with French or German national bonds, but they have always done so; American railroad bonds offer higher interest than British railway debentures, but this also is nothing new; in Japan, Mexico, and Brazil a 5 per cent return is available with moderate safety; and yet in the past these allurements have not tempted the conservative investor to neglect British securities offering a smaller income. Now apparently they compete successfully, so that British securities suffer. Hence it is argued that British credit has fallen. We do not see it that way; to us it appears more reasonable to impute the change of financial sentiment to another and more pleasing cause; namely, the improved conditions in foreign countries and in America. By reason of the investment of English capital and because of English influence in the development of industrial security under improved government, such countries as Japan and Mexico have ceased to be rated among the semi-civilized; on the contrary, financiers deem them no more likely to repudiate their debts than Great Britain herself. In America, despite the financial legerdemain of a few predatory individuals, the general tendency has been toward affording better safeguards for the investing public, therefore the higher rate of interest is now more attractive than formerly. But even in America the rate of interest obtainable on gilt-edged securities is steadily declining; if a comparison were made between the rates obtainable on the best bonds twenty years ago and today it would be seen that the earning power of money has declined, as in England.

Magmatic Segregation.

Magmatic differentiation is a subject that will not down any more than Banquo's ghost. It is really an ancient theory; perhaps it antedates the science of geology. The old notions return with rhythmic persistence, because truth abides in each of them. No one theory of ore-formation can cover all cases. Even the conception of intrusive veins has been revived for us with the endorsement of Mr. J. E. Spurr; he assures us that many quartz lodes are only dikes of the extremely acid residuum of a progressively differentiating magma. Mr. F. L. Garrison discusses this interesting subject elsewhere in this issue, reviewing it from the standpoint of basic rather than acid concentrations. Gravitational segregation finds ready acceptance, but both central and peripheral enrichments are also known. Nature refuses to construct ceaselessly after the same pattern. Her laws are many, and admit of changing styles. Hence convection currents and Soret's principle are both called upon to account for the phenomena of magmas with a core of basic, relatively metalliferous, minerals, so common in the case of pyroxenites, and of those with enriched borders, of which the norites present frequent examples. In the vast stretches of time which Nature has for working out her processes the application of mathematic determination of feasibility must not be pressed too far, our data being based on facts observed upon too small a scale. It is stag-

gering to think of either convection currents, or the comparatively limited influence excited by changes in the diffusion-pressure resulting from inequality of temperature, operating through masses of molten rock miles in diameter. But if not these, what forces could have produced such differentiations? That they exist cannot be denied, and that the crystals were not secondary the microscope has proved. But the mere relative enrichment of certain parts of magmas is a different matter from the formation of orebodies by these processes. We believe that such concentrations are not found, unless we admit the classic titaniferous iron deposit of Taberg, Sweden. But, that primary weak concentrations of this character must facilitate further concentration into lodes and masses by hydro-chemical means seems undoubted, and Mr. Garrison has done a distinct service in accentuating that point.

The question of occluded gases in rocks is of equal moment. These possess an interest of the highest order for the economic geologist. They assist in solvency; their elimination promotes crystallization; they probably perform other functions of which we know little. But we may be sure that no gas can be absorbed into a magma with the constituents of which it can chemically react. Hence oxygen is never found. What seems remarkable is the absence of nitrogen, a gas which presents so many difficulties in fixation. Between the power of condensation of gases by a molten magma and the facility with which the magmas differentiate there apparently exists a close connection. This question seems fairly raised by Mr. Garrison's paper and should provoke much helpful comment.

Copper Tendencies.

Copper is the everlasting enigma. For decades it has been the delight of market-jugglers, and the confusion of speculative wise-acres. That copper has been on the free list and consequently subject to the tidal movements of economic law may in part account for the phenomenon. The public looks ever for the cloven hoof; it believes less in natural law than in the mysterious market-influences of sinister operators in Wall Street. The public has persisted in regarding the Copper Producers' Association as a Trust in disguise, attributing the low price of copper to the malicious designs of that organization. In point of fact no combination for regulating production and prices exists. Such a combination would undoubtedly be effected were it possible, but there are too many powerful producers independent of the Amalgamated to permit that concern, as the natural nucleus, to gather the others into a solid concretion. The independents can make copper more cheaply than the Amalgamated. There's the rub. To depress prices would injure the Amalgamated more than its rivals. In fact the apparent influence at the moment of the lesser lights in the copper firmament would be to reduce prices in order to crowd out the Montana mines and keep a bona fide market for their own output. It costs money to store copper; it is said that syndicates have retired more than nine million dollars' worth within the last few months, deeming it preferable to lock up money for a period in this unremunerative manner than to incur the costlier damage following the closure of great mines and works. How long such a strain can be endured depends upon the abundance of money at low rates. Financial conditions just now peculiarly favor the policy to which the copper producers have been obliged to resort. Money goes begging in Paris at one per cent, and it is considered that French capital is probably carrying the present excess of copper production. Meanwhile the producers are lowering prices to stimulate a demand from actual consumers. It cannot be truthfully said that the depression in the copper market is sympathetic with the cut in steel prices, for copper had been selling proportionally too low for the ruling rates in iron and steel.

Depression is usual in the winter and early spring months. In the last eight years the lowest level in the price of copper occurred once in December, three times in January, twice in February, and once in March. Moreover the current market price is not as exceptional as many are inclined to think. The average rate in 1902 was 11.52 cents per pound, which is below present quotations, and the average of the three years 1902-4 inclusive, was 11.92 cents. It is undoubtedly true, however, that costs of living and of supplies were less in those years, which would admit of meeting successfully a more adverse market. Many mines which were highly profitable at one epoch, under one set of economic conditions, find difficulty in maintaining themselves against the counter-currents of an altering industrial era. Hence it is not surprising to see the copper magnates reaching out for great deposits of low-grade ore which can be worked more cheaply. There probably has been no period, save during the months of insane speculation at the zenith of the late boom, when copper properties were in greater demand than at this very time of low prices and over-production. A good mine, that will admit of producing refined copper laid down at tide-water for 8 cents, will not need to look long for a purchaser. But the day of the 12-cent copper mine is passing. The narrow vein, the deep mine, are looked upon with doubt. The copper miner today wants orebodies so large that he can work them, after the manner of iron mines, with steam-shovel, or by the caving system. The only thing that can recommend a small vein today is the presence of precious metals in the ore sufficient to render the copper in large part a by-product. Mines of the type of the Utah Copper, the Boston Consolidated, the Nevada Consolidated, the Miami, the Ray Consolidated, which it is claimed can deliver electrolytic copper in New York at a cost of 8 cents or less, and of the Cerro de Pasco in Peru, which is credited with delivering it at 7, are the sort that the so-called trust-magnates are reaching after. The result will likely be the development of a dominant group —a Trust. It seems inevitable. Only those lesser operators who can make copper as cheaply, or more so, can survive. The engineer who estimates the future of a mine on a cost-basis higher than 9 cents per pound is clearly in danger of misleading his client.

BY THE WAY.

On the occasion of its 21st birthday, *The Financial Times*, London, published a retrospect. Among the articles was one by Mr. W. R. Lawson, from which we abstract as follows:

When one begins to think of those who are dead and gone, dozens of City ghosts arise out of the forgotten past. But before conjuring them up, it will be necessary to decide how to classify them. The ghost of Baron Grant, for instance, would hardly be welcome among past Governors of the Bank of England. Neither, perhaps, would it feel at home among the disembodied Duchesses who once paid court to the Baron in Lombard street. In order to avoid confusion among the spirits to be conjured up, it may be advisable to borrow distinguishing terms from the dramatic profession. Instead of using invidious names, let us regard finance as being of two kinds—legitimate and illegitimate.

When the period began Baron Grant was still among us, but his sun had set. He had withdrawn from the stately offices at the corner of Lombard street and Nicholas lane to humbler, but still handsome, quarters in Cannon street, near the railway station. There, in 1886, I had my first and only interview with him. He gave one the impression of being a constitutionally and incurably sanguine person.

But, if he failed himself, be blazed a path for those who followed him. His successors—Whitaker Wright, Hooley, and the rest—had a double advantage over him. They had machinery and methods ready to hand which he had helped to create. At the same time, they had a much more credulous public to operate on. Joint stock securities were much more familiar, as well as much more popular, in 1895 than they had been twenty years sooner.

In its later stages illegitimate finance was taken up by a new kind of trust companies, formed ostensibly for other purposes. The Trustees' Executors' and Securities Insurance Corporation was, according to its original charter, to administer private estates, but, almost from the outset, it launched into promoting. It soon had a crowd of imitators, and in the years 1887 to 1889 more speculative issues were made than in the preceding ten years. The collapse of 1890 brought them to a sudden end, and in the hard years which followed, very few of the promoting trusts escaped re-organization. That drastic medicine agreed with them, however, and in course of time their securities came all right again. On the whole, it would be hard to say if the public has been better or worse for the trust companies of 1888-89.

Opinions will differ widely as to how Kaffir finance should be classified—whether as legitimate or illegitimate. The kindest thing to say of it, perhaps, is that it has seen a good deal of both. In its hot youth, twenty years ago or more, it was a diggers' gamble and produced a good many unsanctified money-bags. But when Cecil Rhodes and his associates appeared on the scene it improved its manners and by slow degrees got the entrée into Park lane. In the end it bought up Park lane and made it an annex of the Rand.

The first Kaffir boom, that of 1887-88, was only a preliminary canter. The real boom did not arrive until 1895, and there can be no question as to how it should be classified. Of all the gambling manias the City has ever known this was the rankest, the wildest, and the most disastrous. More money was made and lost in it than in any half-dozen previous booms and panics. It ruined ten times as many people as the South Sea bubble, and no doubt it had an indirect share in precipitating the Boer war. Whether it be a mere coincidence or something more, it is a strange fact that hardly one of its leaders survived it more than a few years. The Barnatos are nearly all gone, and every big Kaffir firm has lost one or more of its partners. Even the two chiefs of the Anglo-German South African Imperialists—Cecil Rhodes and Alfred Beit—both died comparatively young.

The next episode of illegitimate finance which distinguished the quarter-century was the Whitaker Wright campaign. Unlike the Hooley escapade, which was a mere burst of all-round lunacy, this was the work of a clever but unscrupulous artist. If he had remained in his proper country, the United States, Whitaker Wright might have been alive still and hobnobbing with Harrimans and Hawleys in Wall Street. His wholesale combination of promoting, stock rigging, cornering, and plunging generally was much too big for the City. The only place where it could possibly have succeeded was New York. There Whitaker Wrights abound in every skyscraper, and nothing he ever did in Lothbury would have been considered more than smart in Broadway.

Meanwhile it is a comfort for the City to think that the race of financial freebooters is fast dying out. There has been no daring operator since Whitaker Wright, and it is hardly likely there will be another for a long while. That particular financial game is played out. Through painful experience the public has learned its tricks and now fight shy of them. In this respect—and it is a very important one—the City has advanced greatly in the past quarter of a century. The company-promoting form of illegitimate finance, for which a slovenly law feebly administered was chiefly to blame, can no longer do much harm. It has been found out, and, until it invents new traps for the investor, will have a poor living.

Legitimate finance, to which we now turn, is a much more savory subject than the illegitimate sort. In this the past quarter of a century has been prolific. There has been an immense expansion of banking, both home and foreign, in the City. Home banks have undergone a large amount of consolidation, and their management is now concentrated in a few strong hands. They do not, however, enjoy any monopoly, nor are they ever likely to. There are too many active foreign banks planted all round them to give them a chance even to think of getting the whip hand entirely. But the Bank of England holds it for them, which comes to the same thing and is less invidious.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

JAPET LINDEBERG is at Seattle.

FRANK KEITH is at Pioneer, Nevada.

H. C. HOOVER has returned to London.

O. B. PERRY has returned to New York.

H. W. TURNER is at Good Springs, Nevada.

J. R. FINLAY is expected in San Francisco.

GEORGE T. COFFEY is on his way back to Dawson.

ALLEN H. ROGERS has returned to New York from Chile.

H. FOSTER BAIN is expected in San Francisco on April 1.

R. A. LINTON, of Inquerres, Colombia, is in San Francisco.

L. C. CHURCH, of Joplin, has been examining mines in Oklahoma.

R. C. SHAW is examining mines in Tuolumne county, California.

E. G. R. MANWARING has left Cananea to accept a position at Butte, Montana.

EDWIN E. CHASE has returned from Juneau, Alaska, and is now in Oaxaca, Mexico.

EDWARD STABLES, of London, is examining mines in the Kennedy district of Nevada.

C. A. PRINGLE is now manager for the Yampa Mining & Smelting Co. at Bingham, Utah.

JOHN B. FARISH was delayed in San Francisco by illness; on recovering, he went to Denver.

W. L. COBB has returned to San Francisco from Granite Basin, Plumas county, California.

W. B. DEVEREUX & SONS have moved their office from 15 William street to 64 Wall street, New York.

W. E. THORNE has been engaged for inspection work in Brazil, and sailed from New York on March 25.

D. J. COOK succeeds H. M. ADKINSON as manager for the New England Gold & Copper Mining Co., at Bingham, Utah.

WALTER W. BRADLEY has resigned as assistant manager to the Ventanas Mining & Exploration Co., in Durango, Mexico, and is now at Berkeley, California.

GEORGE O. BRADLEY, manager of the Silver Peak mine and mill, has returned from Salt Lake City. He will shortly take charge of the Ray mine, at Kelvin, Arizona.

GEORGE W. TANTAU, superintendent of the copper mines being worked by the Pacific Improvement Co., at Ione, Amador county, California, was in San Francisco this week, purchasing machinery for the company.

GEORGE E. COLLINS is about to retire from the active management of the Argo Mining, Drainage, Transportation & Tunnel Co., at Idaho Springs, and will be succeeded by Roscoe B. Morton. Mr. Collins will remain associated with the company as consulting engineer.

Obituary.

WILLIAM WALLACE CHISHOLM died on March 18, at the age of 67. He was one of the notable men of Salt Lake City, where he had lived since 1869. In the unfolding of the mineral resources of Utah he has achieved rare distinction. He was the leading spirt in the development of the Emma mine, one of the famous silver-lead bonanzas of the Alta district, a property which he managed with great success. Even more conspicuous was his connection with the Centennial Eureka, at Tintic, Utah, a property which has become one of the dominant factors in the development of that State. Under his direction the Centennial Eureka paid in dividends $2,110,000, and was then sold to the United States Mining & Smelting Co., of Boston, for $2,100,000. Mr. Chisholm has been identified with the industrial life of Utah in every direction. He was noted for his philanthropy and for many public spirited acts which have promoted the welfare of his adopted city.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, March 25.

Antimony	12@12½c	Quicksilver (flask)	44@45
Electrolytic Copper	15½@16½c	Spelter	6½@7c
Pig Lead	4.45@5.40c	Tin	32@33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 18. £. s. d.	Mar. 25. £. s. d.
Camp Bird	0 15 9	0 16 0
El Oro	1 3 9	1 4 0
Esperanza	2 11 0	2 16 3
Dolores	1 10 0	1 10 0
Oroville Dredging	0 10 6	0 10 3
Mexico Mines	4 12 6	4 16 3
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver. per oz.
Mar. 19	12.12	3.98	4.76	50½
" 20	12.12	3.98	4.76	50¾
" 21	Sunday.	No market		
" 22	12.25	3.98	4.76	50⅝
" 23	12.37	3.98	4.76	50¾
" 24	12.37	3.98	4.76	50⅝
" 25	12.37	3.98	4.76	50¼

MINING QUOTATIONS—NEW YORK.

	Closing Prices. Mar. 18.	Mar. 25.
Amalgamated Copper	68½	70⅝
American Smelting & Refining Co	84¼	87
Boston Copper	11¼	10½
Butte Coalition	22⅝	23¾
Cumberland-Ely	7⅝	7¾
Dolores	6¼	6¼
El Rayo	2⅞	2⅞
Giroux	8¼	8
Greene-Cananea	9¼	9
Indiana Sonora	3⅜	3¾
La Rose	6⅜	6⅜
Miami Copper	13¼	13⅝
Nevada Consolidated	17⅝	18½
Newhouse	3½	3⅝
Nipissing	10⅝	10¾
Ohio Copper	8¼	6½
Tennessee Copper	41¼	41⅛
Utah Copper	41½	42⅜
Yukon	4¼	4⅛

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. March 25.		Closing Prices. March 25.
Adventure	7⅝	Mass	4¾
Ahmeek	150	Mohawk	63
Allouez	38½	North Butte	69½
Arcadian	4¾	Old Dominion	50½
Atlantic	13	Osceola	129
Calumet & Arizona	101	Parrot	32¾
Calumet & Hecla	620	Santa Fe	2⅛
Centennial	29	Shannon	14½
Copper Range	75½	Superior & Pittsburg	14
Daly-West	10½	Tamarack	77½
First National	6	Trinity	13⅜
Franklin	14	United Copper Con	12⅜
Granby	95	Utah Con	40½
Greene-Cananea, ctf	9	Victoria	4¾
Isle Royale	25½	Winona	5¾
Lake	17	Wolverine	141

(By courtesy of E. F. Hutton & Co., 490 California St.)

SOUTHERN NEVADA STOCKS.

San Francisco, March 25.

Atlanta	$ 11	Midway	$ 21
Belmont	88	Montana Tonopah	68
Booth	17	Nevada Hills	1.35
Columbia Mtn	10	Ophir	1.02
Combination Fraction	94	Pittsburg Silver Peak	65
Daisy	42	Rawhide Coalition	65
Fairview Eagle	10	Rawhide Queen	49
Florence	3.30	Round Mountain	80
Goldfield Con	7.72	Sandstorm	10
Gold Kewenas	13	Silver Pick	7
Great Bend	17	St. Ives	14
Jim Butler	18	Tonopah Extension	65
Jumbo Extension	12	Tonopah of Nevada	7.10
MacNamara	32	Tramp Con	4
Mayflower	15	West End	33

General Mining News.

ALASKA.

The report that the Chicago creek coal mines had been purchased by the Westinghouse Electric Co., proves to be untrue, though negotiations had been made between these parties about the construction of a power plant for general mining uses in the Peninsula. It now appears that the Alaska Fuel, Power & Transportation Co. of New York is undertaking to furnish means for the economic working of the Seward Peninsula, in much the same comprehensive way that the Yukon Gold Co. is operating the Klondike region.

ARIZONA.

MOHAVE COUNTY.

A rumor is current in Kingman that a strike of gold ore has been made in one of the dikes near Mud Springs by E. W. Walker. The strike was made on a vein running in the direction of the Pilgrim mines and is about half way between Burns' ranch and Mud Springs.

PINAL COUNTY.

Contracts for the new 2000-ton Miami mill which is to be erected at the properties of the Miami Copper Co. at Miami, near Globe, have been closed in New York, and work will begin before long on the construction of the plant.

Papers have been filed in Florence recording the deal made three months ago, whereby Lewisohn Brothers, of New York, acquire the property of the Kelvin-Calumet Mines Co. for $2,000,000. The terms are that $300,000 is to be spent in developments in the next year, the balance of the price then to be paid if the property develops as specified.

YAVAPAI COUNTY.

(Special Correspondence).—The Big Stick Co., operating on the Santa Maria, in the Eureka district, has a most promising gold mine. A 20-stamp mill is practically completed and a 500-ton cyanide plant will be ready for use in the near future. Four thousand feet of work has been done on the property, principally in shafts No. 3 and 9. Considerable ore is blocked out on the 100 and 200-ft. levels, but too much water has been breaking in to make deeper workings desirable until the mill is ready to use the water that will be pumped from the workings. Fifty-five men are employed in two shifts. Thomas E. Campbell is superintendent of this property, as also of the Haynes Copper Company.

Prescott, March 19.

YUMA COUNTY.

The people of Bouse and Salome are making a fuss about new discoveries of bonanza ore in the Granite Wash range to the north of the Santa Fé railroad. They claim that prospectors are flocking in from every State, and are sending out samples worth hundreds of thousands per ton. J. J. Sullivan and Homer King, a real estate man, are the principal boomers of the discovery.——The old Desert mine, situated 2½ miles north of Vicksburg, is being prepared for extensive operations. Josiah Winchester states that he has all the material on the ground for his new 10-stamp mill and that he will build it at once. The Desert group comprises 12 claims and is divided about equally on either side of a porphyry dike. A new well at the Desert furnishes all the water for any mill which may ever be installed. It is 90 ft. deep and has 60 ft. of water. There are already some 20 houses in the camp.

CALIFORNIA.

HUMBOLDT COUNTY.

Work is in active progress at the mines at Orleans, owned by the California Dredging & Mining Syndicate, of which Fred T. Hale is superintendent. The mine is now being opened up on a large scale and is backed by New York capital. Four giants are being used under a head of 450 ft. The mine was formerly known as the Orleans Bar Gold Mining Company.

MADERA COUNTY.

Plans are being prepared by the Mud Springs Gold Mining Co. to erect a mill with a daily capacity of 50 tons of ore. There are 15,000 tons of ore blocked out in the mine, and over 1000 tons of $6 ore on the dump. C. M. Johnson is president, S. M. Stenhouse vice-president, and F. O. Horn, secretary.

NEVADA COUNTY.

The El Oro Quartz Mining Co. has been formed with a capital of $100,000 to operate the Marcotte mine at Gaston. The directors chosen to serve the first year are S. W. Wilcox, of Oakland, Baker W. Badger, V. W. Lothrop, and E. A. Gray, of Berkeley, T. B. Gray, of San Francisco, and Harry G. Gray, of Nevada City.

SHASTA COUNTY.

James McBride and Al Graham, two pocket-hunters, found a small ochre seam on the east side of the river from Coram, from which they extracted $1600 in a day. The pocket was near the Pioneer ditch that furnished water to the Old Diggings district in early days.

SIERRA COUNTY.

A rich strike is reported from the Fairview mine at Relief Hill, which is being developed by Charles Wilson, of Downieville. Free gold occurs in a streak of black manganese on the hanging wall. A 10-stamp mill will be built in the spring.——The new tramway being built for the Gray Eagle mine at Gold Point is fast nearing completion. The cable is being put in place and will soon be in running order. The electric plant is also nearly installed.

SISKIYOU COUNTY.

The old San Jose ditch, originally opened up by John Chase for placer mining, is being repaired by a force of 30 or 40 men. This ditch originally cost $125,000. It starts about 11 miles above Scott Bar.——The Quartz Hill hydraulic mine is running night and day with three men on each shift. The giants have been working for two or three months under a pressure of 350 ft. Captain Noonan, of San Francisco, is the owner and operator. T. F. Magoffey is working five men at the Dunn and Vanderlipp mine on Scott Bar. No bedrock has yet been found, although the work has gone down about 30 ft. He has a pressure of about 250-ft. head at the giants.

TRINITY COUNTY.

The Gem placer mine near China Flat, on the border between Humboldt and Trinity counties, is in successful operation, but their equipment is not yet complete, as owing to the heavy fall of snow this season, they were unable to transport all of their machinery. Part of this is at Korbel, awaiting the opening of the roads, after the snow has melted in the mountains.——For some years there has been an agitation to build a State highway through Siskiyou, Trinity, and Humboldt counties. Small appropriations have been granted, but attempts are being made to change the route to one along the Mad river; whereas the road of most benefit to the mining population would be one following the valley of Trinity river from North Fork to Willow creek in Humboldt county, as a wagon-road already exists, connecting Willow creek with Korbel and the railroad.——A 10-in. shoot of rich ore has been struck in the Enterprise mine, on the east branch of the North Fork of Trinity river. The find was made in a drift from the 500-ft. winze, which was sunk in the Lone Jack tunnel, 1000 ft. long. Boston people own the property. George Stenwick is superintendent.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The Mammoth mine on Brown Mtn. has been taken over by a syndicate headed by B. J. Martelon, of Silver Plume. The bond of $25,000 is to be taken up by May 15, while a large working fund has already been subscribed. Martelon states that a concentrating plant of 25 tons capacity daily will be erected.

while machine drills are to be installed. Work has been under way for the last eight months, and an orebody is exposed 6 ft. wide, worth from $22 to $25 per ton in silver, lead, and zinc.——A new strike was made this week on the Gambetta property, situated on Republican Mtn. The discovery was made where the Gambetta joins with the Peters vein. There is showing an 8-in. streak of ore that carries 55% zinc, 30% lead, with 1 oz. gold, and 80 oz. silver per ton. W. A. Wood, the manager, states that the compressor and machine-drills will arrive in a few days, when work will be resumed in the adit on the Washington vein.——R. B. Morton, of Idaho Springs, has been appointed manager of the Newhouse adit, succeeding G. Collins, who remains as consulting engineer. During the last week 60 new 3-ton cars arrived and are now being used to relieve the congested condition of the tunnel workings. During the month of February the advance made was 225 feet.

GILPIN COUNTY.

The Fifty Gold Mines Corporation has shipped 1173 oz. bullion as a result of a 30 days run. Most of the ore mined has been from the Bobtail and Fisk veins at a depth of 1400 ft. The developments during the past few months, under the management of Marshall D. Draper, have opened up large orebodies in the lower workings. The main shaft is to be deepened 200 ft., and the Gregory cross-cut on the 1400-ft. level is to be continued. Employment is being given to 125 men.——Work is to be begun at the Carroll mine in the Eureka district. A 6 by 8 in. engine and a 35-hp. boiler have been delivered at the mine, and I. F. Dawson will soon have the shaft unwatered.

TELLER COUNTY.

A district to the southwest of Cripple Creek is being developed that has previously received but little attention. J. M. Small and others are working a group of claims on Mt. Flagstaff, sinking a 2-compartment shaft on the Homestake lode. The ore found is oxidized quartz, and assays about $9 per ton. Not far beyond this property is the adit of the Red Cloud Mining & Milling Co. This has been driven a total distance of 706 ft. and has opened up a mineralized dike fully 18 ft. wide.——The British-American Mining Co. has shipped 17 cars of ore from the Dante No. 2 shaft on Bull hill since March 1. This leasing company is mining ore from the fifth, third, and first levels, and the shipments settled for to date have brought returns of $18 to $34 per ton. The total production from the Dante mines for the six months ending December 31, 1908, was $59,356 and the total output to date $535,800.——The Golden Cycle Co. will adopt a concentrating system for its new plant near the shaft of the mine, instead of a cyanide installation, such as has been recently adopted by the Portland company. The resulting concentrate will be sent down to Colorado City for final treatment.

The quarterly report of the Gold Dollar Consolidated Co. shows that the lessees have done about 825 ft. of development work at an average cost of $15 per foot, and that the company has done about 100 ft. more in dead work. A dividend payment of ½c. per share is to be paid on April 10.——Measurements taken at the Drainage tunnel, on the evening of March 16, show a gain of 476 ft. for the three headings. The distance from the portal to the breast was on that date 5383 ft., and the two headings of the Intermediate shaft 801 and 751 ft. respectively, making a total distance of 6935 feet.

IDAHO.

IDAHO COUNTY.

C. E. Semple, owner of the Buck Horn mine, in the Four Mile country, 14 miles from Elk City, has just struck a well-defined vein, 15 ft. wide, of good ore at a depth of 60 ft. The vein has been traced for more than 1000 ft. and shows the same kind of ore all along.——More than 50 properties in the Elk City district are ready for placer mining, and prospectors are locating claims which have made good showings. The Chicago Dredging Co., of which P. J. Jennings is manager, will begin work early in April. A ditch eight miles long will be constructed to furnish water for the properties owned by the Chicago company. There is an abundant supply of water this season.

KANSAS.

CHEROKEE COUNTY.

The greatest achievement recently made in the Galena camp is the draining of Short Creek bottom, which was a tract extensively mined in the early days, but abandoned when the water became unmanageable. The work was done by the Lockport Mining Co. Many old miners hastened to secure leases, and when the ground was unwatered 16 companies were ready to start work——A. O. Ihlsing is rapidly sinking a 6 by 16 ft. shaft north of Galena. The shaft is going through solid rock at the rate of 8 ft. in three shifts. The capping of the shaft has been set in concrete.——The latest interest in the Baxter Springs camp centres in the tract between Baxter Springs and Keelville, where leases on thousands of acres have been taken to be prospected for oil, gas, coal, galena, and zinc-blende.

MICHIGAN.

Underground conditions at Trimountain remain unchanged. Shaft No. 4 continues in copper ground of exceptional richness, and with shaft No. 1 furnishes the bulk



The Missouri-Kansas Zinc Belt.

of the 'rock' being shipped to the mills. The north drifts on the fourteenth level in shaft No. 3, and the north drifts on the fourteenth and fifteenth levels in shaft No. 2 are in about 250, 600, and 300 ft. respectively, and are all breasted in good copper ground.——The A shaft at Isle Royale is being sunk steadily, and has reached a depth of 200 ft. The ground carries considerable epidote, but is so far barren of copper.

MISSOURI.

JASPER COUNTY.

(Special Correspondence.)—The old Plymouth Rock mill, northeast of Joplin, which has been idle for a long time, and was in a bad state of repair, has just been remodeled and made ready for operation. Pumping has been started, and the ground will be worked to the 100-ft. level, where there is still a good showing of ore.——Harry Gundling has recently moved the old Maude L. mill from its former site to the new position in Chitwood, at the Cumberland, which now has two shafts down to the 160-ft. level. Underground work has been under way for a long time, so that the new mill can be kept supplied with ore.——The old Emperor mining tract, southwest of Joplin, is being revived. The shallow deposits have been worked, and the shaft is to be sunk to extract a deposit between 145 and 156 ft. The property is near the new Matthes Bros. mill.——A 45-ton

steam-shovel has just been installed in an open cave in the Mohler-Smith ground, at Carl Junction. The cave is 1100 ft. long by 200 wide. A 250-ton mill is on the lease and plans are under way to erect a second one of 150 tons capacity.——A new company, the Nashville Investment Co., has begun operations in the Zincite camp, on the Fisher and Renfrow lands. Both tracts were mined extensively for shallow ore some years ago. On the Fisher tract five shafts are in ore, all above the 100-ft. level. Two shafts on the Renfrow land have revealed a rich run of zinc-blende. A contract will be let at once for a 150-ton mill.——A large zinc-blende deposit was found east of Carthage, in the bed of Spring river, where blasting was being done to enlarge the mill-dam at Forest Mills. The find is important, being the first made in that community, and the neighboring landowners are much interested and may start prospecting.

Joplin, March 20.

MONTANA.

FLATHEAD COUNTY.

George McKay, Charles McDonald, Duncan McDonald, and Samuel Rabekin are the owners of the Missouri group of



Map of Butte District.

claims on Leigh creek not far from Libby. There are seven claims in the group and gold ore and galena have been found on each claim. About 200 ft. of development work have been done.

SILVER BOW COUNTY.

(Special Correspondence.)—The Ophir mine, which becomes the property of the newly organized Butte Central Copper Co., was formerly an asset of the Butte Central & Boston, a bankrupt concern, the new company being really a re-organization, with a capitalization of 250,000 shares of the par value of $10 per share. Half of the stock has been issued to pay off the obligations of the old company, and the remainder stays in the treasury. The directors of the new company are: Sir Frederick W. Borden of Ottawa; Willard E. Robinson, George F. Woodley, W. Harry Thompson, and Freeman I. Davidson, of Boston; William H. North, Robie W. Tufts, William G. Burns, and W. R. Tillinghast, of Providence, R. I. The Ophir is a developed mine, having a shaft 550 ft. deep. The property has been a considerable silver producer, and on the lower levels the ore has been increasing in copper, offering hopes that with greater depth the ore will be found to carry good commercial copper.—— The management of the Davis Daly Copper Co. hopes to make a producing mine out of the Colorado before many more months have passed. Recent diamond-drilling has disclosed a good orebody at a depth of 1400 ft., about 385 ft. west of the shaft. The cores assayed 3½ to 5% copper. A cross-cut is being run toward the orebody and another will be made from the 1200-ft. station. The Davis Daly Co. is doing no work at any of its other properties.——Reports from No. 1 mine of the East Butte Co. indicate that a good copper mine is being opened there. The drift on one of half a dozen veins that have been cut by the 900-ft. crosscut has progressed a distance of about 75 ft., and the size of the orebody continues uniform, from 7 to 8 ft. wide, and the copper content also holds well, running about 8% copper and 10 to 12 oz. silver per ton. The drift has about 160 ft. more to go until the west end-line of the company's ground is reached. There are eleven shafts on the company's property, No. 1 and No. 11 being the main ones. It is the intention of the company to extract ore and store it while the development work and cross-cutting goes on.——Work is progressing rapidly in the Copper Eagle mine, a silver producer in the northern part of the Butte district. The new level at a depth of 350 ft. is being opened. East of the shaft the drift on the vein has been extended 265 ft., and on the west 45 ft. A recent shipment of ore returned $100 to the ton. The company will install a complete electric plant, as it is needed for the economical handling of the ore already blocked out, and is expected to pay for itself in a few months in the saving of coal. President Burnett claims that ore to the value of the entire capitalization of the company, $250,000, is blocked out in the mine.——The Parrot Co. is developing the Parrot vein on two new levels. No large or very rich orebodies have yet been opened, but the showing on the 19th and 20th levels is better than on the 18th. The Parrot vein is very erratic, the ore being found in pockets and bunches. At some points the vein is 60 to 100 ft. wide, and at others it is a mere streak, so thin that miners follow it with difficulty. It is quite certain that it will be a long time before the Parrot Co. can again pay dividends from ore mined from the Parrot mine. However, the Little Mina, which is practically a new mine, is developing into a good producer, a lot of development work being done on the 10th and 12th levels.

NEVADA.

CHURCHILL COUNTY.

(Special Correspondence.)—The Nevada Hills mine, at Fairview, is being further developed by a force of 20 men. The principal vein, which is a fissure in the andesite, is opened by a 400-ft. shaft and four cross-cut adits, which, with the drifts and winzes, aggregate about 6000 ft. of work. The ore consists of quartz carrying free gold, sulphide and chloride of silver occurring in shoots, and chimneys at the intersection of the main vein with cross-fissures. The dividends paid by the Nevada Hills in the last three years amount to $375,000. Some experimenting has been done in the way of tests by concentration and cyanide, with the view of milling the lower-grade ore. Among the men interested in this mine are W. V. Rice, J. R. Davis, J. A. Kirby, J. T. Hodson, W. H. Clark, and W. H. Webber, the last named being the manager.

ESMERALDA COUNTY.

J. H. Mackenzie has confirmed some of the reports about a big strike in the ground of the Consolidated company. It appears that the find is within the boundaries of the Combination No. 1 claim, instead of on the adjoining Mohawk, as was first reported. The Secretary, A. H. Howe, says the ore-shoot has been opened on the fourth, fifth, and sixth levels, and they are now 40 ft. above the fourth level and still raising in ore. No stoping has yet been done on the orebody, but in development alone ore worth about $300,000 has been extracted in the last two weeks. The centre streak assays high up in the thousands of dollars, and in places the orebody is shown to be 30 ft. in width.

James D. Sword announces his intention of building a 400-ton smelter at Luning to treat the copper ores from the Mayflower and Consolidated Mines Co. With him are associated L. L. Patrick and C. Walter Geddes, former superintendent of the Consolidated.——Numbers of outsiders are

coming to Mina to take advantage of the new discoveries close to town. On the Elizabeth claim, assays made from samples taken from different portions of the ground gave returns of $74 gold per ton.——W. E. Lindsay has sold his quarry near Mina to Davis Bros., of Yerington. This quarry is said to be the only black Egyptian marble workings in the United States. The marble is jet black, laced with gold, and variegated with green and copper colored veins. The purchasers acquired 65 acres from Lindsay and have about 60 acres of their own adjoining it. The quarry will be equipped with polishing machinery and cranes to handle large blocks. One block taken out recently weighed 45 tons. ——Suit for $500,000 damages has been filed in the District Court by D. Mackenzie & Co. against the Mohawk Mining Co., George Wingfield, and James R. Davis. One hundred thousand dollars of these damages are against Wingfield and Davis as being bondsmen for the Mohawk company.

LANDER COUNTY.

Hill Top seems to be making progress in the finding of new orebodies. The Philadelphia Western Co. has lately cut a 5-ft. vein on the 200-ft. level which shows an average value of $70 per ton, with a portion that is of shipping grade. There is a shaft 90 ft. deep, and an adit is being run to cut the vein on which it has been sunk.

LYON COUNTY.

L. Humphries, consulting engineer for the Mason Valley Mining Co., states that that company has now secured all the required water-rights, and a smelter-site consisting of 1500 acres in Yerington valley, and that with the opening of spring, work will be at once started upon the erection of a smelter by the Mason Valley Co. The Southern Pacific railroad has promised the immediate building of a railroad through the Yerington district.

NYE COUNTY.

(Special Correspondence.)—A winze west of the main shaft at the Sphinx has cut two bodies of ore between the 110 and 200-ft. levels. They are said to be from four to six feet wide and worth from $12 to $15 per ton. R. B. Wanpler, president of the Round Mountain-Fairview Co., announces that the mine and mill will commence activities at an early date. A fair reserve of ore has been developed.—— Contracts have been signed for the delivery of electric power to the Round Mountain mill, and the current will be available by May 15. The mill is producing more than $30,000 per month.——It is reported that the mill of the Montgomery-Shoshone Co. is to be enlarged at an early date. ——The Springdale mill, at Beatty, is being placed in shape to treat ore from near-by properties.——A new compressor and machine-drills are being installed at the Round Mtn. Daisy mine.——It is rumored that a 12-ft. orebody running $100 per ton has been cut on the 210-ft. level of the Pioneer mine. About 90 tons of ore are being produced per week. Arrangements are under way to install a 40-hp. hoist, a 60-hp. engine, and a 6-drill compressor. This machinery is expected within a few days.

Round Mountain, March 17.

(Special Correspondence).—The flow of water into the Mispah shaft of the Tonopah Mining Co. has increased during the past week from 25,000 gal. to 37,500 gal. The Aldrich pump is kept running three hours per day, in which time it empties the 12,500 gal. sump at the 1200-ft. station three times. The shaft is now down 1284 ft. The Red Plume shaft of the same company is down 500 ft., and a quartz vein has been disclosed at the bottom. So far it proves to be of no value. Four hundred and forty-two feet of new ground were broken during the week in the Tonopah Co.'s ground. The mill crushed 2650 tons of ore yielding 62 bars of bullion valued at $825 a bar, and 28 tons of concentrate worth $525 per ton. The total shipments from the above amounted to $65,900.——The Montana Tonopah opened up 204 ft. of new ground during the week, and crushed 1030 tons of ore, of which 646 were from the Montana and 384 from the MacNamara. The bins for MacNamara ore have been cleared out, and from now on the whole 40 stamps will be run on Montana ore only. A small filter of the Butters type is being installed to further clarify the solution from the Butters filter. A large gold solution tank is being fitted up as a settling tank to increase the slime-settling capacity of the plant.——The double-compartment shaft in the MacNamara is now down 640 ft. in the dacite intrusion. It will be put down to 800 ft., and prospecting will be begun at that level. The company sent 200 tons to the Western Ore Sampling Works at Millers, in addition to the 384 tons sent to the Montana mill.——The Belmont, West End, Jim Butler, and Tonopah Extension did the usual amount of development work last week, the Belmont leading with 214 ft.——The King Solomon Mines Co., controlled by the Forman brothers of Tonopah, have decided to let leases on their property, and during the past week several lessees started work on the company's ground. The property is 9 miles northwest of Crow Springs and 35 miles northwest from Tonopah. It is a silver-lead ore, galena being the predominant mineral.——The Broken Hills mine at Clifford shipped 25 tons of ore valued at $200 per ton to the smelter from Tonopah. The ore was hauled to Tonopah from Clifford by 10-horse teams, and thence shipped by rail.

Tonopah, March 22.

So great is the placer activity at Manhattan that all of the Mustang, Mustang Extension, and Rainbow gulch areas have been leased, and one shaft has been started on the lower part of Main street. The whole gulch down to Central and out into Smoky valley is a hive of industry.

At a stockholders' meeting of the Tramp Consolidated, held in Philadelphia, a minority report was presented to the directors, requesting that they submit a final report to stockholders, discharge all workmen, and close down everything indefinitely.

NEW MEXICO.

GRANT COUNTY.

The development of the Ridgewood claim of the Eureka Sylvanite Mining Co. is at present attracting the chief interest in the camp. The Ridgewood vein has been opened up in ten different places over a length of about 600 ft., mostly by shallow shafts and open cuts. An adit is being driven to cut six stringers of high-grade ore which have been found on the surface. One of these is about 8 in. wide and assays $96 per ton, while others show coarse gold without need of assaying.

OKLAHOMA.

OTTAWA COUNTY.

Northwest of the main Miami camp three mines have recently opened up deposits which far surpass the general run of ore. They are the Golden Hen, the Consolidated, and Jennie May. The ore was found at a depth of about 100 ft. Plants have been erected on the Golden Hen and Consolidated, of 200 tons capacity in each case.

OREGON.

HARNEY COUNTY.

A valuable opal find has been made on Thousand creek, in the extreme northwestern part of this county and about 20 miles west of Denio. The scene of the find is close to a 'petrified forest' which probably has a similar origin to the opals. The stones discovered by L. Denio and his partners are said to be of good size and quality.

JOSEPHINE COUNTY.

The shipment of 17 tons of ore from the Oriole mine at Galice brought J. C. Mattison returns at the rate of $210 per ton. This ore has come from a vein 40 ft. wide which contains a narrow streak of high-grade in the middle. Mattison will at once put up a stamp-mill and a cyanide plant of sufficient capacity to take care of the low-grade ore as fast as it is mined. As a preliminary, the construction of a wagon-road from Galice to the mine, a distance of two miles, is to be begun immediately.

TEXAS.

The new law passed by the Texas legislature provides that all land now owned by the State shall be thrown open to mineral prospectors, locators, and purchasers. The law

specifies that a claim shall consist of 21 acres or less, and describes the methods by which the prospector must establish his rights. The owner of a claim shall have one year from the date of filing his affidavit in which to prospect his claim. The price to be paid for claims shall not exceed $25 per acre. It is believed that the new regulations will greatly advance the mining industry of the State, as most prospecting has heretofore been done on private lands.

UTAH.

BEAVER COUNTY.

The Frisco Consolidated Mining Co., whose property has the extension of the Horn Silver contact vein, is expected to resume operations next month. Development consists of a 550-ft. shaft, with some cross-cutting and drifting. The equipment comprises hoisting and pumping machinery, and further development will be carired on. D. P. Rohlfing of Salt Lake City is manager.

JUAB COUNTY.

E. C. Coffin, superintendent for the Lower Mammoth Mining Co. at Tintic, is putting down a new 3-compartment shaft in place of the old one. The work has already passed the 900-ft. level, and is progressing about 10 ft. per day. At the present rate it is said that the 1200-ft. level will be reached by the middle of April, and development work will then begin in earnest on the 1000, 1100, and 1200-ft. levels. ——The shaft of the Emerald Mining Co. at Tintic is now down 1092 ft., and as soon as the 1100-ft. mark is reached, drifts will be run to find the continuation of a narrow but very rich streak previously discovered in a winze. J. L. Yundt is general manager.——Development work upon the 300 and 400-ft. levels of the Yankee Consolidated mine has now nearly reached a point where the Beck Tunnel vein should be driven into. Prospecting is also under way upon the 500 and 600-ft. levels, but L. Merriman, the superintendent, has temporarily suspended work below the 600-ft. level.

SALT LAKE COUNTY.

(Special Correspondence).—There has been a consolidation of the holdings of the Butler-Liberal, Butler M. & M. C., Ben Butler No. 3, Utah Development Co., Hooghly, and Vespasian, aggregating 275 acres on Markham canyon, in Bingham district, by the North Utah Mining Co., of which W. D. Bohm, of Salt Lake, is manager. The old workings amount to over 20,000 ft., and a new shaft is to be sunk, with connections to various parts of the group. The ore is mainly lead-bearing, but it is accompanied by silver and a little copper. It occurs in shoots within fissures in quartzite. Some shipments have been made lately the gross value of which was about $60 per ton. The shipping, however, is incidental to development, and Bohm's plans contemplate deep work. A big tonnage of milling ore has been opened, but is not blocked out. The capital employed in this enterprise is all British. This consolidation does not include the Utah-Apex group, as was previously published.

The Utah Copper Co. has 80 acres of overburden on its Bingham canyon property, with an average depth of 70 ft., all of which contains copper ranging from ¾ to 1%. D. C. Jackling will put up an experimental plant for the treatment of this low-grade material before summer.

The Utah-Apex property, although adjoining the Utah Consolidated in the Bingham canyon, is not a copper property. Of course it has copper ores, but the bulk of them carry a prepondering value of silver and lead. The last 97 smelter shipments by the Utah-Apex Co. have aggregated 7158 tons, of a gross value of $152,600, or $21.25 per ton in silver and lead. The Utah-Apex Co. is now shipping 150 tons of ore per day and from these shipments is earning at the rate of about $1000 net per day.

SUMMIT COUNTY.

Work at the Daly West mill, which has been closed for several days on account of the lack of water, has been renewed. The water for the mill and the mine will be received from Ontario lake, which has begun to flow again.

TOOELE COUNTY.

Work on the International Smelting Co.'s railroad, from the Salt Lake Route tracks through Tooele City on to the smelter in Pine canyon has nearly reached Middle canyon, where a trestle will be built. At the rate progress is being made it is a certainty that the railroad will reach the smelter site by May 1.

PHILIPPINE ISLANDS.

A. Heise has gone back to Manila after testing the ores of, and purchasing the plant for, the San Mauricio Mining Co. This property consists of 10 claims near the town of Mambulao, Camarines, on the east coast of Luzon. There are three known veins on the claims, and it is on the San Mauricio vein that the greater amount of work has been done. The new equipment consists of a 20-stamp mill and concentrating plant, obtained from the Traylor Engineering Co. The situation of the mine and mill, near the ocean, gives the advantage of cheap transportation, and the concentrate obtained will be shipped to Australia or America. Accompanying Heise was D. E. Blake, a mining engineer from Colorado, who is to be in charge of the work at mine and mill.

CANADA.

BRITISH COLUMBIA.

The Ymir Mining Co. has issued $2,000,000 in common stock, and has already raised over $100,000 with which to prosecute development in its mines at Ymir. Diamond-drilling is now in progress at the property for prospecting 500 ft. below the 1000-ft. level.

The Granby Consolidated Mining & Smelting Co., of Grand Forks, has bonded for $100,000 a group of promising copper claims, near Tassu harbor, on Moresby island, the second largest of the Queen Charlotte islands, and has made one payment upon the bond. These claims, which are owned by Messrs. Connors, Parks, and others, are situated in the immediate neighborhood of the group in which Thomas Taylor, the minister of public works, holds a quarter interest.——A fire took place in a west stope on the 400-ft. level of the Centre Star mine last week. R. H. Stewart, the manager, and his assistants were soon on the spot, and were able to prevent the fire spreading to the shaft and upper levels. At the time the fire was discovered only a few men were in the mine, and no lives were lost. The cause of the fire at present is unknown.

MEXICO.

FEDERAL DISTRICT.

The repairs to the timbering of the Mexico shaft are finished. During the time this work has been progressing the mill has been kept running on ore accumulated on the dumps.——The report of development in the Descubridora mine at El Oro shows that the east and west cross-cuts are 270 and 228 metres long, respectively. A dike has been passed through, at one side of which was found some rich ore in the Chihuahua mine, to the north.

OAXACA.

F. W. Taylor has opened work on two of his properties in the Santiago Minas district. The properties are known as the Copper Queen and Copper King.——Preparations are being made for the re-opening of the work on the Zavaleta mine. The property has been idle for the past year.

The Ocotes mine, situated between Oaxaca and Ejutla, on the Teruel road, is soon to install diamond-drills for prospecting below the sixth level. The mine is the property of the Teziutlan Copper Mining & Smelting Co., and it is practically assured that this company is arranging to build a smelter on this mine. The diamond-drills will be installed at once and the vein will be thoroughly prospected at least 1000 ft. deeper.

SONORA.

The Greene-Cananea Co. is preparing to add 80 vanners to its present concentrating equipment, which consists of two mills with a daily capacity of 2400 tons of ore. L. D. Ricketts, the designer, says that the additional vanners are to be put in for the purpose of increasing the efficiency of the plant and not with any idea of increasing its capacity.

Special Correspondence.

DENVER, COLORADO.

Forest Service Defended.—Gilpin County Revival.—Cripple Creek Development.—Tariff on Lead.—New Oil Field.—Geological Report.—Record Tunnel Driving.

During the week ending March 20, Gifford Pinchot, chief of the Forest Service of the United States, met in debate the various individuals and associations that have grievances to remedy and suggestions to make regarding amendments in the regulations of the Service. On March 15 he met a delegation of the American Mining Congress, composed of Callbreath, Mills, Bancroft, and Daniels. The questions that were brought before the last convention of this body concerning the hardships to prospectors and miners under the regulations were discussed. The contention is that prospectors have been driven from the preserves by the rangers, and that permission has been refused to miners to cut timber on their claims. The conference between the members of the Congress and Mr. Pinchot resulted in the endorsing of several amendments to the regulation to correct the hindrances to prospecting. On March 16, at the Forest Service branch office, which has been doing business in Denver since the first of December, Mr. Pinchot received delegations, and conferred with the local officers and rangers. On that evening, he addressed the joint assembly of the Colorado legislature, at whose request he came to Denver. Here he met in debate, Mr. Ammons, State Senator, a practical stockman of Wyoming and Colorado. Among other things, Mr. Pinchot said that President Taft had given him authority to say that he is heartily in favor of the present policy of the Service. Mr. Pinchot declared that the general policy of creating and maintaining the National Forests had been accepted by the people of the United States and may be regarded as definitely and finally fixed, and he urged the co-operation of the American people. He warned the people of Colorado against the Power Trust, which is gradually growing to be the biggest trust of all. He read from the pages of the Bureau of Corporations, showing that the Central Colorado Power Co. was deeply encroaching on the water resources of the State and already included as subsidiaries the Leadville and Colorado Springs Lighting companies, Northern Colorado Power Co., Denver Gas & Electric Co., Summit Power Co., and others; that the stock of the company is held by the Westinghouse and General Electric companies, and that the American Gas Co. has a ruling hand in its affairs. The head of the forestry department showed that this company already controlled a great part of the waters of the State, and were it not for the Forest Service, the great power companies would soon control them all. Mr. Ammons made a strong point as to the right of the United States Government to set aside vast tracts of land in any State and assume jurisdiction over the lands to the exclusion of the State. He said the small stockmen were at the rangers' mercy, and that there were men living on the reservations who were in a state of terror through fear of the power of the ranger. Mr. Pinchot showed that were it not for the Service there would be no small stockmen, but that all the grazing land would be in the control of the owner of large herds. On Wednesday, Pinchot addressed a meeting at Boulder, and met delegations from Fort Collins and Longmont. On Thursday he again conferred with the American Mining Congress, and also met the Chamber of Commerce of the city of Denver. On his trip Mr. Pinchot is accompanied by A. F. Potter, assistant forester.

The beginning of the revival of Gilpin county is seen in the opening of several old mines which have been idle for years. The Topeka group, in Russell district, a former good producer, idle for eight years, is to be re-opened. The Alps property on Quartz hill is being worked by lessees and a recent shipment returned 7 oz. gold per ton. The property is owned by Hal Sayr, of Denver. It is reported that another good vein has been cut in the heading of the Newhouse tunnel, which is now under the 'Patch' on Quartz hill. The lode is supposed to be either the Illinois or the Pocahontas. The Jim Blaine group and Daisy mill-site in Independent district has been sold to the First National Bank of Central City. The deposit is the largest low-grade orebody in Colorado. The value will run from $3 to $4 per ton. The ore reserve is estimated at 1,000,000 tons. It is the intention to erect a large mill of 300 tons daily capacity.

A syndicate of Boston capitalists has taken a five-year lease on the property of the Free Coinage Co., of Cripple Creek, to operate that property below the 550-ft. level. The property consists of the Pinto, Rising Sun, Wilson, Bison No. 2, and Pueblo claims, forming a compact group on Bull Hill. These have been recently examined by Forbes Rickard, of Denver, who will act as the consulting engineer for the new company, called the Altman Leasing Co. Sixteen sets of lessees are now working on the mine above the 550-ft. level, and these operations will not interfere in any way with the operations of the new company on the lower levels. Operations under control of the Altman L. Co. are to commence immediately on the Pinto claim, and the shaft, which is now 575 ft. deep, is to be sunk to 1000 ft. No lateral work will be done until a depth of 800 ft. is reached. A new hoisting plant will be erected in place of the old equipment now on the property. The production of the Free Coinage to date is over $2,000,000 from above the 550-ft. level, and a heavy production is expected from the lower workings.

The State Geologist, R. D. George of the University of Colorado, has completed his first biennial report covering the work done by the Survey since its establishment two years ago. The principal features of the report are the surveys of the Hahn's peak region, the Montezuma district in Summit county, the tungsten area of Boulder county, and the topography of the foot-hills from the Wyoming line to a point south of Boulder.

The proposed reduction of the tariff on lead from 1½c. per pound to 1c. per pound is causing uneasiness among the lead producers of this State. A committee has been appointed by the president of the American Mining Congress to make vigorous protest through the Colorado representatives in Congress. There are many mines in Leadville, Clear Creek, San Juan, Summit, Park, and Chaffee districts working on so small a margin of profit that they will have to close if the proposed reduction is made.

Excitement has been caused at Grand Junction by the reported discovery of oil in Fremont valley, just over the Utah line. More than 25,000 acres have been located, and prospectors are flocking to the district in large numbers. At Florence, all operators whose wells show signs of exhaustion are preparing to deepen them. This is due to the success of lessees of an old well belonging to the Rocky Mountain Oil Co. By deepening this to 3000 ft. a flow of 100 bbl. per day was secured.

The Gold Dollar Con. M. Co. has declared a dividend of one-half cent per share, to be paid on April 10. The production from this mine has been larger during the past three months than during any like period in its history. Those interested in the Necessity claim on Battle mountain have ended the litigation, which has tied up this property for the last six years, by forming a new company. The directors of this new Uintah-Ajax Gold Mining Co. are residents of Denver and Colorado Springs. The Necessity claim contains three acres, is patented, and contains valuable ore. Work will be started at once. Record-breaking progress is being made at the Cripple Creek Deep Drainage Tunnel. Between March 1 and 17, 476 ft. was gained. The distance from the portal to the first heading is now 5383 ft., and from the foot of the intermediate shaft a total of 1552 ft. has been driven. The annual meeting of the stockholders of the Jennie Sample Con. M. Co. promises to be a sensational affair. It will occur at Cheyenne, Wyoming, on April 2. The fight is to oust S. S. Bernard, now president of the company. Charges of mismanagement have been made by the opposition, and letters asking for proxies have been issued by both parties.

LONDON.

El Oro Mines.—Kolar Goldfield.—A Chameleon Company.

The chairman of the Exploration Co., R. T. Bayliss, has just returned from an extended visit to Mexico, where he has been making special examinations of the El Oro and the Mexico Mines of El Oro, which are properties under the guidance of his company. He has issued an interesting statement relating to the Mexico Mines of El Oro which shows that the mine is becoming a larger proposition than was originally expected. When it was first opened, the deposit consisted of three or four approximately parellel veins not exceeding 7 ft. wide, so that the recent developments which prove that the low-grade or barren ground between these veins has become mineralized at several points, have brought a pleasant surprise. These united veins are for a width of 65 ft. averaging $15 per ton. At numerous other points the veins are found to be 15 and 20 ft. thick. On the No. 6 level is found a vein of rich ore which may turn out to be a continuation of the bonanza of the adjoining Esperanza mine. The rich ore which is found will be sorted up to $150 or $200 per ton and shipped to smelters, the waste being sent to mill. It is not at present intended to increase the output of the mill, but to wait further developments. The mill is up-to-date, consisting of 40 stamps, tube-mills, and cyanide plant. It treats about 9000 tons per month, and yields a monthly profit of £12,000. Its capacity has proved to be nearly 50% higher than was originally estimated.

Though the general prospects and conditions in the Kolar goldfield, of India, are not in the aggregate quite so satisfactory as might be hoped, yet the original Mysore mine is going as strong as ever, and is indeed in a remarkable current of prosperity. Its old rival, the Champion Reef, is in poor ground, and is making only a fraction of its former profits. It is the more interesting therefore that at all three principal centres of development the Mysore continues to open up wonderfully well. At Ribblesdale shaft-work is going on at the 3908-ft. level, and the vein is found to run from 23 to 34 dwt. in value, and from 2½ to 3 ft. in width. At McTaggart's the lowest workings, 2385 ft. deep, show a vein 24 dwt. in value and 6 ft. wide. Developments during the year have added to the ore reserves, which now stand at nearly a million tons, equivalent to five years' supply, averaging over 1 oz. per ton. A year ago I mentioned the adoption by John Taylor & Sons, the managers of this group of mines, of the principle of paying for all costs out of revenue instead of issuing new shares when special extensions were contemplated. The effect on the nominal dividend is apparent in the results for 1908 which are now published. Though the prosperity of the company has been fully maintained, the rate of dividend is only 115% as compared with an average ranging from 130 to 150% during the previous seven years. To the casual observer (and I am afraid the bulk of investors come under this category) the company does not look as successful now as formerly. The difference is accounted for by the inclusion of nearly £80,000 in the expenditure account for new plant, which formerly would have been met by the issue of new shares. The production during the year was valued at £848,145 from 206,170 tons of ore, and £350,055 was distributed as dividends. It is worth noting that since the commencement of operations in 1884 the company has produced gold aggregating a value of £10,785,687 and has distributed approximately half of this in dividends.

In one of your recent editorial notes you referred to the disinclination of an English mining company ever to give in, and instanced the Briseis. An even more characteristic case is to be found in the history of a company called Tarkwa Consols. It was formed in 1901 to acquire properties on the West Coast of Africa during the time when that part of the world was 'the fashion.' No sort of practical mining was ever done nor was the value of the property ever properly ascertained. When West Africa went out of vogue two or three years ago, and the chairman of the company, Mr. Francis Allen, was becoming interested in Cornish matters, the company abandoned its name and assumed the title of Cornish Adventurers. Options were taken on various properties in Cornwall in conjunction with Mr. Allen's other companies, notably on Wheal Sisters at St. Ives. The failure of this mine to materialize, together with a slump in tin, made the company's operations in Cornwall of no avail. Fortunately for the company, West Africa has been looking up again during the last six months, and money has once more gone in that direction. Certain people in London approached the company with a view to resuscitating its claims in Tarkwa, and a favorable arrangement has been made whereby a diamond-drill prospecting expedition is to be sent out to thoroughly test the veins. To keep up with the times, the company's name has been moved back once more to Tarkwa Consols, and Mr. Allen and his shareholders are as sanguine of success as they ever were.

MEXICO.

Guanajuato Activity.—Zacatecas.—Black Mountain, Sonora.—Oaxacan Railroads and Mines.

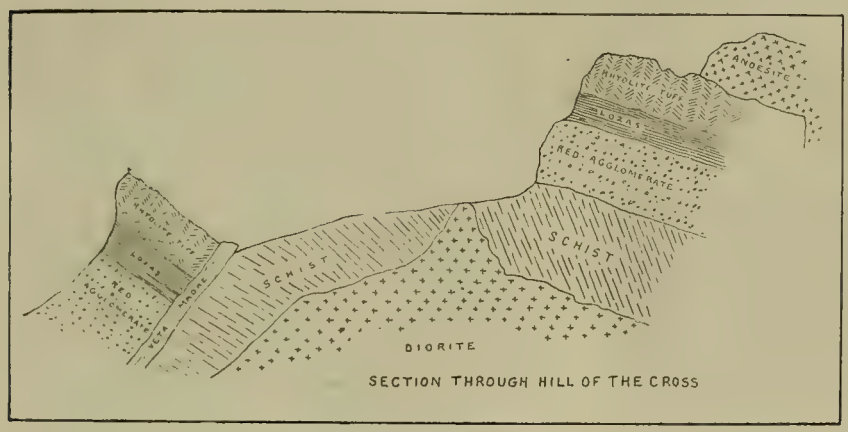
Notwithstanding the low price of silver none of the Guanajuato properties have closed. On the contrary, many have increased their output, so that the total production of shipping ores and of bullion continues well above the quarter million pesos per week, and it is expected that this year will see a material addition in new mines and mills. The Santa Natalia, being worked by Mexico City capital, has its small new mill nearly ready for operation, and the Tres Coronas and Margarita of the Mexican Mining Co., in which development has yielded such splendid results, will begin shipping as soon as the mill of the Vignos company is completed. This is north of La Luz. The stamps are lifted by eccentrics instead of by cams, and a higher capacity is claimed. It will treat ores from the Tres Coronas, Margarita, and Los Reyes. The Guanajuato Amalgamated Gold Mines Co. is installing the Butters filter system in its Jesus Maria mill, and is running a surface tram to the old Villa Rino dumps. The Guanajuato Mines Syndicate has resumed work on the Loreto, and is sinking the shaft; while the Pinguico company is sinking a new shaft to develop the side veins. The San Angel, of the Puertocito de La Luz, and El Roble, are both in good ore, and the unwatering continues at the San Cayetano. In El Cubo the tunnel has been completed to the Villalpanda shaft, a distance of 7000 ft., and will, of course, be of great assistance in mining and handling the water. The Guanajuato Reduction & Mines Co. has also put in a surface tram, for handling the ores on the dumps at the San Antonio, from Tepeyac to Valenciana, whence the ores will be taken by aerial tram to the Bustos mill. Cortlandt E. Palmer and associates, among whom are E. A. Wiltsee and Frank G. Peck, have obtained control of La Luz and Refugio and other properties in La Luz district, comprising approximately 1500 acres, and have organized what will be known as the Refugio Mines Syndicate for developing the properties.

Zacatecas is greatly encouraged over the work being pushed forward in that camp. The 300-ton cyanide mill, and the steam-electric power-plant for the Bote mine are practically completed, and will soon be handling ore from the large body of low-grade material blocked out in this mine. The Magistral's new 300-ton smelter is also nearing completion, but in the meantime the mines of the company are producing as usual; and the Nueva Quebradilla is constructing a 75-ton concentrating plant for its low-grade sulphides. The Zaragosa, Cartagena y Anexas, and the San Roberto are nearing the productive stage, and it is said a strong American company is after the Veta Negra, on which, if obtained, work will be pushed.

In the State of Sonora, outside of Cananea, comparatively little new work is going on. The Black Mountain M. Co., at Cerro Prieto, has obtained a Federal concession, similar to that of the Cananea Consolidated Copper Co., for the introduction of fuel-oil free of duty, and will soon use oil at its steam-plants. The Venturilla M. Co., operating near Santiago de los Caballeros, of which A. R. Crowell of Los

Angeles is president, is developing a fine body of lead silver ore under the management of H. F. Wilson. The West Coast Co. is opening good ore in the Todos Santos, near Santa Cruz in the Cosalá district; and the Mina Grande, in the Badiraguato district, controlled by Jack Crawford of San Diego, is now on the shipping list, sending its product out by way of Culiacán.

In Oaxaca the old Hamilton railroad, better known as the San Juan Taviche, which was taken over by the Mexican Southern, is now to be pushed to completion by that company from Ximatlán to San Gerónimo, and will open up almost the whole of the Taviche district and give an outlet for its ore. This should enable the Oaxaca Smelting & Refining Co. to obtain supplies of smelting ores, and it is understood that H. M. Holbrook, president of the re-organized company, is making preparations to blow in the furnaces immediately upon completion of the railroad. At the San Carlos, in Taviche, which has been worked in rather a haphazard manner, a more vigorous campaign is to be inaugurated, and shaft sinking and drifting will be pushed. For the San Francisco mine a new mill will be erected in Taviche, and the Santa Isabél is to be opened up by Los



The Veta Madre, Guanajuato.

Angeles capital. In the Sierra Juarez district the old Mexico M. & M. Co. is completing the erection of a 30-ton cyanide mill, with stamps and Frue vanners, to be operated by two turbines; it will also have a three-mile aerial tram to the mine. This means a new lease of life for that company. The San José de Gracia, in the same district, is adding a cyanide plant to its mill; and on the Rosario, Corazón, and Manchezo, development is being pushed by Maurice Clark and associates of Mexico City. Near Oaxaca the Santa Catarina has made its first clean-up; the Natividad is nearing completion with its 200-ton cyanide plant; the Frida M. & M. Co. has ordered a 30-ton mill; and the final payment has been made on the Zacaleta by the Pittsburg-Oaxaca Co.; development will proceed more rapidly in future. The Victoria of Taviche has been taken under a lease by English people, and the Victoria of the Tepada Mining Co., in the Totalapám district is to have a cyanide mill. The Guebeshe mill in the Ocotlán district has been put in commission. On the Mascota mine, San Carlos, the Pioche adit has cut the vein at 125 metres, and the Mascota adit is in 60 metres with a like distance still to run before reaching the vein.

The Calabacillas mine in the extreme western part of Chihuahua near the border of Sinaloa, has shown remarkable results. It was purchased a little more than a year ago by William H. Brevoort, and has been managed by Arthur J. Underwood. The mine produced nearly $100,000 from 7000 tons of ore in 1908, thus showing an average value of $14 per ton. The ore is gold and yields 80% by amalgamation, and a further recovery of 80% of the gold remaining in the tailing is made by cyanidation. An adit is being driven which at a distance of 3000 ft. will cut the vein at a depth of 1000 ft. below the outcrop.

In Tepic the Certuchena mine has been taken over by the Tepic Gold Mining Co., of Los Angeles, California, a concern controlled by Marshall P. Wright. The property is situated only 5 miles from the line of the new S. P. branch, that is, the Cananea, Rio Yaqui & Pacific railway. A 10-stamp mill is to be erected immediately. The ore is said to yield a recovery of over $8 per ton, or 80%. The company claims to have ore enough developed to feed a 10-stamp mill for 15 years. The Clark Copper Co., with extensive holdings in Sonora, is now in control of George H. Stewart, J. R. Smurr, and J. Ross Clark, representing the discontented minority stockholders, 'Patsy' Clark of Spokane and his associates having retired from the directorate. The headquarters of the company will be in Los Angeles, California. The operations will be confined to the Magistral mine, in the State of Sonora.

TORONTO, CANADA.

Gowganda District — Transportation Problems. — Cobalt Stocks. — Dividends Payable.—Crows Nest Coal.

The Gowganda district is attracting more attention than Cobalt, where the possibilities for the prospector, the promoter, and the miscellaneous crowd that always flocks into a new mining district, is superior. The situation is growing serious, owing to the difficulties of transportation, the improvised sleigh-road from the end of steel at Sellwood being utterly inadequate for the volume of traffic; moreover, this is likely to break up at any time on the advent of spring weather. It is estimated that some 12,000 people are in the country and only a few days' provisions on hand. In the intervening season, between the breaking up of winter and the opening of navigation, the community will be practically isolated, and unable to obtain fresh supplies, so that unless a sufficient supply be laid in meanwhile, much hardship may be experienced. The Canadian Pacific railway has arranged for a canoe freight route on the opening of navigation from a point on the line 35 miles west of Sudbury, following a number of lakes and watercourses to Gowganda. Steam launches will be put on the long stretches where they can be used, with horses on the principal portages to facilitate trans-shipment. An impetus has been given to the boom by a Government sale of lots in the Gowganda town-site, 130 lots being disposed of by tender at an average price of $136 per lot, realizing a total of $17,664. The highest price paid was $412, and the lowest $25. This week a large deputation from the north country waited upon the Provincial Government and strongly urged the immediate extension of the Canadian Northern railway to the Gowganda district, and the building of a permanent wagon-road.

Cobalt stocks continue depressed, in sympathy with unsettled conditions in the American market. The multitude of new Gowganda flotations also absorbs a good deal of the money that would otherwise be invested in 'Cobalts.' Cobalt Lake experienced a rally a few days ago on account of the discovery of a new 12-in. vein in the cross-cut from No. 6 shaft at the 135-ft. level. The vein is rich in native silver, which also appears in the wall-rock for 12 in. on each side. The cross-cut is being driven close to the McKinley-Darragh line, where some good veins are looked for. An important find has been made on the Nipissing vein No. 64 at a depth of 172 ft. It is here 5½ ft. wide, 18 in. of which assays over 2000 oz. per ton. The Crown Reserve has declared a quarterly dividend of 6%, with an additional bonus of 9%

payable April 15. The Chambers-Ferland recently made a good discovery in cross-cutting from No. 2 shaft at the 80-ft. level, the vein being 4 to 6 in. wide, containing cobalt with silver. High-grade ore averaging over 5500 oz. is being taken from the adit at the 150-ft. level. In the Columbus, at a depth of 250 ft., and 51 ft. east of the shaft, a 2-ft. body of galena has been found. The Temiskaming, concerning which disquieting rumors have been afloat, has declared its regular quarterly dividend of 6% to be paid April 1. During the fiscal year it produced 1,026,285 oz. silver, or $494,211, and has 16,000 tons of ore on the dump valued at about $250,000, which will be concentrated. The Buffalo has declared its regular quarterly dividend of 5% payable April 1, and an extra 3% dividend to be paid May 15. Little has been heard lately of the Foster since its good ore gave out, but work is being kept up in the extraction of low-grade ore and in prospecting for new veins under Glenn lake. Some 600 tons of ore on the dump will be treated at the Cobalt Central concentrator. Shipments from Cobalt for the week ending March 13 amounted to 527 tons, from the following mines: Crown Reserve, 50; City of Cobalt, 30; Coniagas, 30; Kerr Lake, 30; La Rose, 103; McKinley-Darragh, 28; Nipissing, 130; O'Brien, 32; Temiskaming, 30; Temiskaming & Hudson Bay, 30; Trethewey, 32 tons.

An important change has taken place in the directorate of the Crows Nest Pass Coal Co., Fernie, B. C. At the annual meeting held here on March 12, G. G. S. Lindsey, president, Robert Jaffray, vice-president, Sir Henry M. Pellatt, and E. R. Wood, all of Toronto, declined re-election to the board. The new board of directors consists of Elias Rogers, Toronto; Mr. Clough, New York; J. P. Graves, Spokane; W. F. Robertson, Granby, Que.; E. C. Whitney and H. McGiverin, Ottawa; and R. M. Young, Toronto, secretary. The new board represents the interests of James J. Hill of the Great Northern railway, who, it is understood, has for some time had a controlling interest in the Crows Nest Pass Co. The reason assigned for the action of the retiring directors is that they did not wish to be longer responsible for the management of the company when the real controlling power was in other hands.

SALT LAKE, UTAH.

Daly-West Resumes.—Dividends.— Ohio Copper. — Cole-Ryan Option. — Ray Con. Copper. — Mason Valley. — Lead Producers Meet.—Yampa Smelter.—Utah United.

The Daly-West Mining Co. has again been able to resume operations at the Park City properties, after a cessation of one week. Both the mine and mill were out of commission as a result of the scarcity of water. The winter freeze and the snows in the high mountains had completely shut off the flow from Ontario lake, but arrangements have been made with the Wabash Co. to provide water for the mine, and the lake will provide the mill. The first quarterly dividend of 30c. per share, aggregating $54,000, has been posted. The last dividend was paid by this company in December 1907. The company has a surplus of about $320,000, after having paid dividends aggregating $5,877,000. The Silver King Coalition Mines Co., also of Park City, has posted its quarterly dividend of 15c. per share, amounting to $187,500. This silver-lead producer has paid over $11,500,000 to the shareholders. Among recent dividends posted by the Utah mines are: Utah Consolidated, $150,000; Colorado, $80,000; Sioux Consolidated, $35,000.

Colin McIntosh, general manager of the Ohio Copper, states that they have continued the Mascotte tunnel 250 ft. beyond the raise that connected with the upper workings. They still have 250 ft. to go to reach the west end of the group owned by the company. The raise in the vein is being continued, and will be sent over to the hanging wall side where the sulphide deposit found on the upper levels showing 20 to 25% copper is expected to be cut.

John D. Ryan has wired that he will be unable to be here for a week to examine the Colorado mine in Tintic and the Tintic smelting plant. The option which the Knights gave the Cole-Ryan syndicate on those properties expired on March 20, but it has been extended indefinitely. That the option-price has been reduced is acknowledged by the Knights, who want to get out of the smelting business and confine their operations to mining. They are anxious to have the smelting operations at Tintic continued.

D. C. Jackling, general manager of the Ray Consolidated, says that they have added in excess of 2,000,000 tons of copper ore to the reserves during the past month. He will visit the mines in Arizona immediately, where he spends half of the month, dividing his time between this and the Utah Copper properties in Bingham. Next month he expects that there will be double this amount added to the reserves, as the drills prove the ore. For a time the drills were set across the country at a considerable distance apart to prove the limitations of the ore zone. Later the ground has been blocked and holes are sent down in each 10-acre block.

The most important strike yet made in the Mason valley properties occurred within the past three days. On the fourth level they have broken into the sulphide deposits. The drift, after passing through the replacement-deposits, is now in 20 ft. on this high-grade ore. Through 12 ft. the ore contains 12% copper and the next 8 ft. shows an average of 27.77. The entire face gives an average of 10% copper. Practically all this ore is of smelting grade.

A number of prominent mining men from Colorado, Utah, Idaho, and other Western States are holding a session in this city to consider the proposed reduction in the lead tariff. A memorial is to be sent to Congress protesting against the reduction. The Coeur d'Alene mine-owners are represented by Harry L. Day of the Hercules mine, W. Clayton Miller of the Federal, J. F. McCarthy of the Hecla, M. A. Folsom of the Bunker Hill & Sullivan, and G. Fred Fratzer. J. F. Callbreath, secretary of the American Mining Congress, with headquarters in Denver, is in attendance.

The Yampa mine and smelter in Bingham canyon, controlled by Grant B. Schley and associates of New York, are now under the management of C. A. Pringle, formerly manager for the Calera Mining Co., at San Isidro, Chihuahua. The Yampa produces sulphide of copper averaging close to 2%. The daily output of 750 tons is smelted at the Yampa plant, which contains screening bins, 9 McDougal roasters, 3 reverberatory and 3 blast-furnaces. The coarse and fine are separated by ⅝ to ¾-in. screens. The fine receives a desulphurizing roast in the McDougal furnaces, whereby the sulphur is reduced to 4½ to 5%. It then passes to the reverberatory furnaces which produce a 30% matte. About 500 tons of fine ore per day are thus treated. The coarse ore, amounting to 250 tons per day, is smelted in one of the blast-furnaces, the other two at present being idle. In the same furnace the matte from the reverberatories is re-smelted. The result of smelting the crude ore with the 30% matte is a product that runs only 25% copper. The low concentration of the coarse ore brings the average percentage down. This matte is treated in converters, there being two stands, which are operated on two shifts per day. In the shells a silicious lining, carrying some gold and silver, is used, and by reason of the matte being so low-grade a larger amount of lining than usual is used. The converter-slag is poured into the blast-furnace settler and the slag from the two is disposed of together. F. J. Murphy, smelter superintendent, states that the company will probably erect a sampling plant and prepare to treat custom ore as well as that from its own mine. The blowers, supplying blast for the furnaces and converters, are operated partly by steam and partly by electric power.

The Utah United Mines Co., owning the old Okay and Skylark groups, situated near Solas station, Beaver county, has kept a small force developing during the past winter and has now a 300-ft. incline, from which cross-cuts have been driven to the 4-ft. vein of ore at three stations. The vein is on the contact between limestone and granite. The ore assays well in copper, with some gold and silver. It also runs high in iron, and only about 18% silica. A. J. McMullen, the manager, contemplates making ore shipments later in the year.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Spheroidal Weathering of Dikes.

The Editor:

Sir—Herewith you will find the photograph of a dike seen near Butte, Montana, that to me exhibits at least one peculiar feature. This dike is found in a cut on the Northern Pacific railroad about eight miles southeast of Butte and about one mile northwest of the continental divide. It is exposed in this cut to a depth of 20 to 30 ft. The railroad is running nearly east and west, while the direction of the dike is approximately N. 45° W. and S. 45° E. The



Curious Weathering of Diabase Dike Near Butte, Montana.

dike has an average thickness of nearly 9 ft. and dips northeast at an angle of 87°; in other words, it is practically vertical.

The country rock is the Butte granite. The dike is composed of diabase, as determined by the microscope, having the typical structure and composition. When fresh the rock is black, but weathering has caused most of it to assume an ashen color.

The dike has a peculiar appearance: it is composed chiefly of globular masses of rock varying in size from a few inches up to about two feet in diameter. These masses are interlocked on their outer edges and each mass is separated into concentric layers in much the same manner as an onion. These layers are not uniform in thickness; they are remarkably regular and distinct, and have comparatively smooth surfaces. This concentric division is wanting or scarcely observed in the fresh rock, but is very marked where much weathered. It seems to be an excellent illustration of circular parting due to weathering. Some of the globular masses do not possess this circular separation to a degree that is distinct, but it is noticeable in all. On both sides of the dike along its contact with the granite, alteration is apparent, especially in the dike itself; the portion affected extends to a depth of several inches, while in the granite the alteration, if any, has a depth of only a fraction of an inch. The dike rock in this altered area is usually not in globular masses, but is arranged in vertical layers varying in thickness from less than one to several inches. In these vertical layers the rock is more compact, of finer texture, but much more weathered than in the main body of the dike. Vertical layers also occur occasionally between the globular masses, but these may be part of the masses assuming a vertical position.

J. R. VILLARS.

Butte, January 20.

The Editor:

Sir—Mr. Villars is to be cordially commended for preserving the picture and preparing the description of the dike near Butte. These fleeting phenomena, which are visible today and gone tomorrow, need to



Spheroidal Weathering in a Dike in a Granite Quarry at Barre, Vermont.

be recorded in some publication of reference, or else they are lost to science. The dike is a fine illustration of spheroidal weathering and of sheeting, both forms of breaking-up being in large degree referable to strains produced in cooling. Weathering has brought out the shelly or onion structure, but one cannot well resist the conviction that some internal structure has facilitated the assumption of these peculiar shapes. A molten dike that has come to rest between cold walls would be expected normally to break up into prisms, whose axes would lie perpendicular to the cooling surface, but if, as was probably in large part the case in this instance, the walls had become heated so that there were no great contrasts in the transmission of the heat in various directions, the prisms might pass into spheroids. The sheeting appears to be approximately tangent to the large spheroids, and to mark a central area. If the sheet-

ing is not due in any respect to faulting movements, its layers may perhaps be considered as the coats of spheres of large radius.

In former years in the hills a few miles north of Butte there were piles of apparent boulders of the Butte granite due to the shelling-off of angular jointed blocks, a result that we often see in the granitic areas of the West, but the process would seem to be radically different from the dike in question. The spheroids, moreover, seem not to be spherulites, due to radiating crystallization, since Mr. Villars' thin sections afforded no such suggestion. In a small way the spherulites are sometimes developed in diabasic rocks, as reference to the peculiar variety called 'variolite' will at once remind a reader. While great spherulites, even larger than the spheroids of the dike here described, were once found by Whitman Cross in the pitchstone of Silver Cliff, Colorado, the Montana dike can be best explained by contraction strains.

It may be of interest to place with Mr. Villars' picture another of a basaltic dike in the granite quarries of Barre, Vermont. The photograph was taken about six years ago by George J. Finlay.

J. F. Kemp.

New York, March 2.

Panama Canal.

The Editor:

Sir—I trust you will pardon this personal letter from a stranger. I have been a subscriber to your paper for some time, and have read practically all of your editorial utterances with interest and approval, except in the case as below noted. Your ideas on mining geology and mine finance and promotion and local political influences of a malign nature, strike me as level-headed, courageous, and independent. But your editorial of December 19 on the Panama Canal has surprised me. For example, you do not understand the complacency with which official circles in Washington regard the payment of $40,000,000 for what could have been bought for five million. I happened to be on the Isthmus officially accompanying the Commission at the time transfer was made, and was familiar with the situation. The old Commission, you will remember, recommended the Nicaragua canal as being better than Panama on account of the expense that would accrue in getting possession of Panama. The Panama Co. wanted, I think, one hundred and ten millions for their rights, property, work done, etc. The Commission estimated that if Panama could be bought for forty million dollars, it would be the more advantageous route. From personal knowledge of the Commission, I believe this was a conscientious estimate, and, in addition, showed shrewd management on their part, as the Frenchmen promptly tendered their canal at that figure, knowing that their property would be much reduced in value if the United States built a canal at Nicaragua.

I have made no estimate of the value of the enormous stock of metallic material on the Isthmus, of the Panama railroad and its terminals, its steamboats, etc., of the vast number of buildings, and the great amount of useful work accomplished, but I am positive that your estimate of five millions is ridiculously low. The Panama railroad is worth more than that. I have understood that even its La Boca terminal cost one million dollars, and I have no doubt that a careful appraisal of the benefit that the present canal received from the French work was well worth the forty millions paid for it. It is, of course, possible that the United States might have driven a harder bargain, owing to its ability to ruin the French company by building a canal at Nicaragua, but I should regard that as an immoral performance alongside of which the strategy in assisting the Republic of Panama into being, to keep Colombia from holding us up for forty or fifty million dollars for the privilege of doing her a great financial favor, is small in comparison. There are two sides to that Panama Republic question, and while the highest grade of national ethics may have been scarred a little in the process, the great good to humanity that will come from the canal, seems to me to amply justify the strategical moves that were adopted to outwit the scheme, which I think even the Colombians themselves would admit as unfair.

In a recent issue you discuss the point of the Gatun Dam having been moved eleven times. I think this is utterly absurd, as I have watched that dam quite closely, and I don't think it has moved an inch since the minority report decided upon it. You hint rather darkly of the corruption which led to the withdrawal of John Finley Wallace. I am curious to know what grounds you have for this. I kept close track of everything that occurred at that time, and while Mr. Wallace's action was inexplicable, and I think Mr. Taft's indignation perfectly justified, I have come to the conclusion that the reason Mr. Wallace left Panama was precisely the same as the reason why the Governor of California did not leave Pasadena during the railroad strikes at Sacramento, a reason proper and all-powerful from their point of view, but which neither of them would feel like publishing.

My greatest astonishment at your editorial, however, is at your remarks concerning Lewis M. Haupt, with whose personal equation I am quite familiar, including his capabilities as an engineer. You can get some light on the latter proposition if you read the discussion of paper No. 14 in the *Transactions* of the American Society of Civil Engineers covering the International Engineering Congress in St. Louis in 1904. The paper was by the undersigned, and the discussion was by Mr. Haupt and the undersigned. The matter is quite lengthy, and on a generally unfamiliar topic, but if you are interested in either Mr. Haupt or his theories of ocean bar improvement, a careful reading of the matter would repay you for the time involved. At one time, Mr. Haupt organized a company to promote his peculiar jetty-theory on the same lines as his proposition for the Columbia river bar. The plan was to have a central trust in New Jersey, with local companies wherever harbor improvements were to be made by the general Government. These companies could have a secret membership covering local politicians capable of influ-

ercing the National Government to adopt the Haupt plan as the one preferred by the maritime and other important interests of the port. I really doubt if Mr. Haupt appreciated the enormity of his proposition. On another occasion, at a meeting of the Isthmian Canal Commission, the question of unit-prices was being discussed, and the majority of the Commission was about to decide on some figures that Mr. Haupt thought were very high. He expressed his criticism thus: "Why, gentlemen, if you adopt such high unit-prices, you will kill the whole canal proposition." I am reliably informed by a member present that there were nine pairs of astonished eyes turned on Mr. Haupt at this, and he abandoned his suggestion.

CASSIUS E. GILLETTE.

Philadelphia, March 11.

Deep Lead Mining in Australia.

The Editor:

Sir—In replying to Newton B. Knox's kindly comment, in your issue of December 5, on my article published by you on October 24, I desire to say that the facts given by Bewick, Moreing & Co. and by Mr. Algernon Moreing with reference to the Loddon Valley mine were quite correct, namely, that the wash is spotty and that the gold contents are unevenly distributed. But they did not, as far as I know, venture on an explanation of the possible reason why this is so, although, in my opinion the cause is evident, as was the failure of the Spring Hill & Central Leads mine about 20 miles nearer the source of the same lead. Another cause may perhaps have contributed to the failure of the Loddon Valley, this being the junction with the main lead, not far above the Loddon Valley shaft, of one of the largest tributary leads in the district, which may have helped to scour the main lead and cause the spotty nature of the gold content. The exact point of junction has not been determined, but all are agreed that it cannot be far away from the Loddon Valley workings.

The Loddon operations demonstrated another potent fact, which, with or without the combination of the tributary lead, would account for the spotty character of the wash, namely, in the extreme north workings gravel was found within 5 ft. of the back of the main level, and this was 50 ft. too deep for the lead. Possibly, had the level been driven farther north the gravel would have been found still deeper. This abnormal hole must have been caused by volcanic action after the gold was laid down in the old river bed, but while the river was still in existence, and the hole caused the river to scour its bed by emptying its contents for a time into the disturbed area, just as Mr. John W. Gregory, of the Victorian Geological Survey, described what took place ages ago in the property of the Spring Hill & Central Leads. The two mines are similar in that they each have an extinct crater of a volcano within a short distance of the lead, and as the Professor said, "when the volcano was active it was creating a vacancy under the bed of the old river until the crust became so thin that it broke and the river poured its contents into the hole." This in itself would be sufficient to cause the scour and account for the patchy character of the wash. Therefore, I consider that the failure of the Loddon Valley Co. is not evidence that our clay leads do not contain gold in large quantities, but simply proves that the Company was unfortunate in having cut the lead at a point where an extraordinary set of circumstances combined to deprive them of a satisfactory return for their outlay.

D. H. BROWNE.

Rutherglen, Victoria, February 9.

Electrolytic Amalgamation.

The Editor:

Sir—In your issue of February 13 there appears an article by E. E. Carey describing an apparatus for electrolytic amalgamation, which, though of the crudest form of construction and inadequate to give the results described, is the basis of a more effective apparatus covered by the patents of W. J. Jory and J. H. Jory, extending from 1893 to 1904.

The perfected electrolytic sluice comprises a scientific system in which the electric forces employed are adjusted by means of instruments of precision, and in which the chemical solutions used are closely conditioned to the requirements of the ores and sands operated on. The apparatus of this system is so constructed as to be automatic in operation, needing but little attention and giving perfect recovery. This statement cannot be truthfully made in regard to such primitive contrivances as are presented by Mr. Carey to the needy millman; for crude methods ignorantly applied can never prove satisfactory.

That the results obtained by Mr. Carey, as recorded by him, are correctly stated I have no doubt; but I am certain they were not obtained by any such contrivance as he describes, nor by any means employed in so loose a manner.

J. H. JORY.

San Francisco, March 18.

What Is an Ore?

The Editor:

Sir—No sooner is a word brought forward for accurate definition than a host of others appear offering hardly fewer difficulties. Mr. Kemp has exhaustively investigated sources of information for a definition of 'ore', and in so doing has attracted my attention to an amorphous word, used quite generally in mining literature. This is 'mineralization'. It is a word loosely applied under different conditions to convey an idea which familiarity has robbed of precision. 'The entire country is heavily mineralized'; so is a vein, in the redundant parlance of the press. In both of these is lack of definite meaning. May I then appeal for further light from the learned lexicographers, and ask 'What is mineralization?'

NESCIO.

Milpitas, March 21.

Lithium decomposes water, forming LiOH. It is entirely unattached by hydrocarbons, and may consequently be preserved in naphtha or benzine.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Pre-heating of water for boiler-feed purposes is estimated to effect a saving of 1% in fuel for each 11° F. which the feed-water is raised in temperature.

False cleavage is a tendency in rocks to split at right angles to the true cleavage of the rock. It is called also 'grain', 'bate cleavage', 'rift', and 'slip cleavage.' It is a different phenomenon from jointure. Advantage is taken of cleavage and 'rift' in laying out quarries in crystalline rocks.

Garnet is exceedingly abundant, being perhaps the most characteristic mineral among those porphyritically developed in the crystalline schists. The crystals are generally from 1 to 4 mm. diam., and are likely to be more numerous along certain planes of cleavage than others, notably following the more highly micaceous layers, and being less prominent in association with the layers which are richer in quartz and feldspar.

The Bradley patent on the electrolytic production of aluminum was No. 468,148, and was issued on February 2, 1892. It accordingly expired in February last. This is the basal patent, but many other patents have been issued, which cover improvements in the process called forth in the light of experience. By the expiry of the original Bradley patent, however, the metallurgy of aluminum is practically thrown open to the world.

Fuller's earth, which is used for bleaching oils and fats, performs this office through absorption and retention of organic coloring-matter. It owes this property to the colloids which it contains, these being colloidal silicates, which in the case of fuller's earth are singular in not being destroyed by drying at a temperature of 130° C. Colloids in ordinary clay would be completely destroyed at that temperature, so that plasticity could not be again developed in the mass.

Tappet-valves in compressed-air drills are of special advantage in dry dusty mines. In the case of spool-valves the wear from dust and grit, which will unavoidably get in to some extent when the air-hose is disconnected, leads to leakage of air past the valve or piston, interfering with the action of the auxiliary ports. This will occasion irregularities in the reversal of the drill, shorten its stroke, and diminish the efficiency because of such leakage and irregularities.

Prospecting a vein by panning tests is liable to lead to error. In a case cited by Wilfrid Taylor good indications from sampling a Rhodesian vein by that method were reduced 50% by subsequent fire assay, owing to the large amount of silver alloyed with the gold. In many of the desert mines of the United States the amount of coarse gold in the leaner portions of the lode is so large in proportion to the amount present in the better ore that panning tests will prove entirely misleading.

Ore-shoots, according to Waldemar Lindgren, may be classified into the following varieties: (a) magmatic segregation shoots, (b) metamorphic, (c) replacement, (d) ascending circulation, and (e) vadose. The most conspicuous concentration into shoots presented in the earlier stages of the great majority of mines are of the latter type. These, in effect, are secondary enrichments. Generally, however, they bear a close relation to primary shoots in the vein before the vadose waters had re-arranged the metallic contents.

Safety-fuse may be tested as to continuity of the powder-train in the core by means of an X-ray photograph, the powder-grains being opaque to the rays. Occasional samples cut from the coils in daily use should be thus tested from time to time, and especially if mis-fires are more frequent than usual. It may prove that a particular consignment of fuse was faulty. The X-ray test is better than a burning test, as it reveals faulty feed in the fuse-machine, which would not necessarily be revealed in burning. The burning powder-train in the fuse-core 'spits' ahead and may thus carry over gaps in a fire-test which it might not bridge in the severer conditions of actual service in blasting.

Clay is a complex mixture of a group of minerals, of which kaolin is the type. This group, known collectively as the 'clay minerals,' varies from a minimum of 12% Al_2O_3 in malthacite to a maximum of 45 in pholerite. The range of silica is from 12% in schrötterite to 64 in pyrophyllite; while the range of hydration is from 5% in pyrophyllite to 35.4 in malthacite. Kaolin has the formula $Al_2O_3.2SiO_2.2H_2O$. The clay minerals are about 16 in number. In addition, clays contain minute particles of undecomposed original rock-forming minerals, mainly feldspars, augites, and hornblendes, with quartz, but it is evident that larger proportions of SiO_2 than the 46% in kaolin may be present in the form of secondary minerals of the clay-making sort.

The draft necessary to overcome the resistance to the flow of air through the coal on a grate of the ordinary type, having about 50% air-space between the bars, is 0.6 of the total draft required for the combustion of the coal. With a closed ash-pit and forced draft the fan must supply air to produce a pressure in the ash-pit 60% greater than the total draft as determined by the formula

$$i = \frac{f^2}{K^2}$$

where f represents the number of pounds of fuel burned per square foot of grate-area per hour, i equals the draft measured in inches of water at the end of the up-take where it joins the chimney, and K is a factor the value of which depends on the kind of fuel employed under given conditions, being usually in the neighborhood of 58.

HOW IT STRIKES AN AMERICAN.—I.

Written for the MINING AND SCIENTIFIC PRESS
By T. LANE CARTER.

To return to America after an absence of ten years causes one to feel like a Rip Van Winkle, for at this stage of American development, a period of ten years shows as much change as would a century in more settled countries. It has been my privilege to visit many of the large mining districts of the United States during the past few months, and it might be of interest to readers of this journal to know how it strikes an American to visit industrial centres of his country after so long an absence. As my time has been spent at the mines of Central and South Africa, it might prove instructive, while writing these impressions, to compare in a general way the mining conditions as they exist in America and South Africa.



Mining in the Rocky Mountains. Pack Train Arriving at he American-Nettie Mine, Ouray, Colorado.

As "no man liveth unto himself," so no industry exists by itself. In considering mining in the United States, attention is first drawn to the industry on which it depends, namely, agriculture. The two industries are so bound together that the success of one affects the other. Cripple agriculture, and mining is at once seriously affected.

Nothing has impressed me more in my trip through the United States than the advance in agriculture during the past ten years. Nature has endowed this land far more liberally from an agricultural point of view than South Africa. One realizes as he goes through hundreds of miles of farms in the United States, that the greatness of this country rests on the surest foundation, namely, that of agriculture. Since my departure from America much has been done for the farmer. With rural mail delivery, telephones, and better roads, his lot today is incomparably better than it was 10 or 20 years ago. These improved conditions are attracting a better class of people to the soil, and today we find gentlemen's sons in the agricultural schools, who 20 years ago would never have dreamed of becoming farmers. The good seed sown in the establishment of agricultural schools, and the application of science to the problems of the soil through the agency of the Department of Agriculture, is bearing abundant fruit.

Next to agriculture, one naturally enquires into the condition of forestry, as mining is so dependent upon this branch of industry. I have been shocked at the ruthless destruction of trees during the past 10 years. In my own State in the South, vast areas that were virgin forests 20 years ago, are today hideous wastes. The greed for wealth has wiped out vast forests, with an utter disregard for the future of the country. We should long ago have followed the example of Sweden, Germany, and other enlightened countries, where the law enforces the planting of a tree for every one cut down. The tax of $2 per 1000 ft. on lumber imported into the United States should never have been allowed, unless the planting of trees had been made obligatory. This tax has merely gone to swell the millions of about 27 men in the United States, who own the majority of the timber-lands of the country. The duty has certainly done no good to the mining industry. I should like to see the tax reversed, and an export duty put on timber to save what we have left. The people seem to be waking up to this question of re-

forestation, and in every mining centre which I visited, I found men talking on the subject, and praising the good work done by the Bureau of Forestry. Every mining man should interest himself in this subject and do what he can to encourage the planting of trees. A man who remains at one place does not realize the terrible encroachments that have gone on during the past 10 years in our forest reserves. He should take a trip through the United States to be convinced.

While on this subject of the waste and destruction of our timber, it might be well to state that one sees senseless waste in other things. I saw on my trip water-power running to waste which would long ago have been utilized in such countries as Italy and Switzerland. In Louisiana natural gas and oil is being wasted, which if saved and utilized would add to the wealth of the State. Many of our coal mines are wasting far more coal than they should. On the whole it struck me that the minimum amount of waste was in the metal mines.

A comparison of the labor conditions in the United States and South Africa would take too long; I can only treat the subject in a cursory manner. The lack of efficient labor has for years been the cry among mining men in South Africa. For a long time efficiency was low on the Rand, but recently there has been a marked improvement, and most of the creditable reduction in working costs in the Transvaal during 1908 were due to the higher efficiency of labor. I heard much also of the inefficiency of labor in this country, both East and West. This is probably due in large measure to the enormous expansion in mining operations during the last 10 years, so that the supply of good miners has by no means equaled the demand. I was told, for instance, in the Lake Superior country that the percentage of Cornishmen working there has diminished considerably in recent years, the demand for good miners farther west having been so great that many of the Cornishmen moved to the new districts. Another cause for inefficiency in some mining districts is due to the labor unions. The theory of paying a poor workman the same as a good man, and of making all men industrially equal, does not promote efficiency. Limiting the output of the laborer is the cause of inefficiency in some union camps.

The mines in Africa have not been troubled with the problem of extreme unionism. The districts are not run by unions. Those that exist do not interfere with the efficiency of the laborers, for the contract system is extensively employed, and this makes for efficiency. In going from district to district I formed the opinion that better and more efficient work was being done in the non-union districts of the United States than in those dominated by the union. I was disappointed with unionism as I found it in America today. Against the right kind of unionism I have nothing to say. The miners should be properly united to protect their interests. We all know that modern capitalism is not philanthropic; that it needs to be legislated and watched; that there are wealthy individuals in America today who would form a monopoly tomorrow if they could to control the air-supply of the United States and charge us so much per breath; that they have adopted the Americanized golden rule as their standard, "Do unto the other man what he would do unto you, but do it first." But an improperly led, improperly organized union is a positive danger and hindrance to the miners, as many of them know to their sorrow. What unionism among the miners in the United States most needs is broad-minded able leaders, not demagogues who simply use the men and the union in order to 'live easy.' They should return to the higher ideals of unionism, which should exist for the advancement of the character and efficiency of the laborers. Workmen should realize that economic laws are as inevitable as gravity, and that decreased efficiency means higher working costs and therefore a contraction of production with a decreased demand for labor. Miners in America are much the same as in Africa—they like to roam. Frequently they are fooled by the high wage offered, and do not realize that what most concerns them is how much they can save from their earnings, and what chances of investment they may have. For instance, in a camp in the East, the miner might earn $75 and live for $25, putting aside $50 per month; but he hears that 'out West' they are paying $90 per month, and away he goes to find that he is fortunate if he can save $40 per month in his new position.

One finds many instances of men among the miners who have the genius for saving and making money, veritable Pierpont Morgans in their smaller way. One man I met—a Scotchman—who came to this country with no money, is now worth thousands of dollars. He has never left the first mining centre he struck. All his savings he put into real estate. He would buy lots, and in his spare time, with hired help, he built houses and rented them. While others spent their nights in saloons denouncing capitalists, this man was quietly working, and today has the satisfaction of having built up a small fortune.

While I believe that the Rand has been the mining region where the frugal man could save most money, there is no question that the miner in America who wants to save has great opportunities to use his earnings in good investments. The level of wages in Africa today is no higher than in some of the better paid portions of the West. But the white workmen in this country have one great advantage over the white artisans in Africa; they have the satisfaction of knowing that they are living where the demand for white labor is constantly expanding; that when they educate their sons and daughters and give them trades, they will be employed in their own country. But in Africa, on account of the peculiar conditions, the demand for white labor is not increasing rapidly. Many a head of a family has looked forward with apprehension to the future for his sons. In America practically all the mining is done by white men; in Africa the majority of it is done by blacks.

Compared with the American underground-worker, the South African miner seems less capable in a general way. In the Transvaal it is difficult to get a white man to do a bit of everything. If he is employed on rock-drilling, he does not want to do

anything else. In America he does differently, and is therefore a more well-rounded workman. On account of the different mines he works in, the miner in this country gets a more varied experience than in Africa.

I found that wherever possible the 'dirty work' of the mine, such as mucking, is handed on to the newcomers, the Huns, Austrians, and Italians, by the Irish and Americans who formerly did this work. The Irish and Americans have gone in for 'bossing' and machine work.

In South Africa more is thought of the miner than of the mechanic, as far as wages are concerned; for years the efficient miner on contract has earned more than the mechanic or carpenter or blacksmith. This has been a sore point with the mechanic in Africa, who claims that he must give years of his life to learn his trade, while the limited knowledge of mining required to run a machine-drill in a Rand mine can be picked up by an intelligent person in six



Empire Mine, Grass Valley, California.

months. In America the mechanic earns more money than the underground-man.

On the whole the office staff in America is smaller than in South Africa. You cannot help realizing this when you go to the Homestake mine and see how few men are in the office there, for a huge concern dropping a thousand stamps. The visitor is impressed, in visiting among the American mines, with the absence of 'side' on the part of the managers, and the friendly feeling that generally exists between the man at the helm and those working under his direction. After all, this is the secret of good management, to cause every workman to feel a personal interest in the success of the concern. You do not find any snobbery among the mine managers in America. Other faults they may have, but they are not snobs.

On the whole, South Africa is far more liberal than America in providing for the comfort and amusement of the men. I saw no recreation clubs or halls at any mine of the United States to surpass the houses built for the employees of the Rand mines. Of course the stability of the Rand, and the fact that the life of the mines is assured for many years, has much to do with providing these better conditions. In America some of the large companies have done much for the comfort and recreation of the men, but on the whole America may learn a valuable lesson from South Africa in looking after employees. Experience on the Rand has proved that it is good business to make the lot of the men as congenial as possible. In some centres that I visited in America, the quarters and accommodations for the men might have been good places in which to rear hogs, but were scarcely fit for human beings. No self-respecting man will remain in such an environment longer than he can help, and as soon as he saves sufficient money he will go away.

It was a pleasure and contrast to go from these pig-sties to the Grass Valley district. Anyone who declares that mining is necessarily hideous, that esthetics and mining are as far apart as the poles, should take a trip to Grass Valley. There he will find that mines may be so adorned with trees and flowers, shrubs and vines, as to become really artistic and attractive. The disciples of the hideous and the unattractive in mining should pay a visit to the North Star and Empire mines in Grass Valley and be shamed into advocacy of better things.



Kennedy Mine, Amador County, California.

After a tour of the United States, I realized the importance of climate in industrial pursuits. Laborers in the Lake Superior district, for instance, as on the Rand, have an advantage over men working in the hot climate of the Louisiana salt and oil deposits. From a climatic view-point, efficiency of men in Michigan is higher than in Louisiana. In a cold bracing climate a man must work to keep warm, while in the heat of the South, it requires will-power to keep up to the mark. In examining mines either in Africa or America, the question of climate should be considered.

One marked difference between American and South African mining is the attitude as to Sunday work. In the Transvaal there is a strict law against Sunday work, punishable with a heavy fine, the maximum being $375. Under the law, necessary work is allowed, such as the running of stamp-mills, pumping, repairing of machinery, and the like, but no one is allowed to work in the mine from midnight on Saturday to midnight on Sunday, without special permission from the Government mining engineer, a permission rarely given. With the principle of the Sunday law all the mining men of the Transvaal agree. Their only contention is that the hours should be from Sunday morning to Monday morning, so as to allow a full shift Saturday nights on those mines which are

falling behind. I noticed that at some mining centres in America, they observe Sunday as completely as in the Transvaal, for instance, in the Lake Superior district. In many mining districts of the United States not the slightest notice is taken of Sunday, work being carried on just the same as on other days. We know, of course, that mining is not like a grocery business where the doors can be opened at 9 a. m. and closed at 4 p. m. A good deal of Sunday work will always be necessary, especially in running huge metallurgical concerns; but I believe there is a tendency to overdo the Sunday work, and the Transvaal law is undoubtedly an excellent one. I am sure that in American mining today too much Sunday work is being done. It is not flattering to us to know that in Africa they are able to keep huge batteries at work all the time, by working six days per week, while in America, where we claim to have 'hustling' down to a science, it is necessary to go seven days per week to accomplish six days' work. I believe it would benefit the mines if Sunday work were reduced to a minimum. The universal experience of the industrial world is that man must have a day of rest in seven, if he is to remain healthy and efficient. Even a machine must rest at times. In the Transvaal some managers try to arrange it so that a part of the men can get off on alternate Sundays. Men in the mills and cyanide plants work on 8-hour shifts, and have a 'long shift off' every third Sunday. Transvaal experience teaches the gain to be had in reducing Sunday work as much as possible. Wholesale Sunday work does not pay.

In the matter of labor-saving devices, South Africa compares favorably with America. While I saw one or two devices which could be used on the Rand to advantage, there are a few Rand 'wrinkles' that our mines could be taken up with profit. Considering the adverse conditions on the Rand, the ore is handled expeditiously. Some of the methods for handling ore in America would be out of the question on the Rand on account of the sinuous and narrow character of the veins. The efficiency of air-drilling in America struck me as being better than in South Africa, principally due to the fact that far higher pressures are used on this side. Recently the air-pressures on the Rand have been increased, and this should improve the efficiency of the drills. Small machines are also used to better advantage on this side. One is impressed with the tremendous development of compressed air in both countries during the past 10 years. The day of the hand-drilling miner seems to have passed, save for prospects and small mines where it does not pay to put in a compressor. Only a small percentage of the ore mined in the United States is broken by hand labor. I believe the same thing will soon be true in South Africa. So far the electric rock-drill does not seem to have 'caught on' to any great extent. From what I have seen the pneumatic drill is knocking the electric into a 'cocked hat.' Managers in America should watch the development of the electric furnace for sharpenings drills underground. Some interesting work is being done along this line on the Rand, and if an extended test should show the furnace to be practicable, such mines as the Homestake and the Calumet & Hecla, where tons of drill steel are handled daily, could no doubt save money by the use of the electric furnace.

In America many of the larger mines make their own rock-drills and claim a saving in expense. This is not done on the Rand, new rock-drills being bought outright from the factories. In the first place skilled labor in Africa is too expensive to allow them to make their own rock-drills, and again, competition in rock-drills is so keen that machines are cheaper there than here. With the huge wall of protection around America, the makers force the mining companies to pay a far higher price for machines than they ask for the same contrivance away out in Africa. If they make a profit out of the South African end of the business, one may fancy what they make in this country at American prices.

(To be Continued.)

Tantalum until recently was little known. It is perhaps the most curious of the metals. A good deal still remains to be learned concerning it. Like most other steel-hardening elements, according to O. M. Becker, it readily combines with carbon; but the carbides thus formed are not soft, as is the case with the others, but very hard. A small amount of carbon is sufficient to carbonize a large amount of tantalum. It is considerably more than twice as heavy as iron, bulk for bulk; is about as hard, when in the annealed state, as soft steel; and has a tensile strength nearly a third higher. When hardened by alternate heating and hammering, metallic tantalum becomes so hard that a diamond-drill will scarcely touch it, while at the same time it retains a remarkable degree of toughness. No information is at hand as to its specific influence upon high-speed steel, but it is known that one maker uses tantalum in steel for drills, dies, and tools of like nature. The strong affinity of tantalum (when hot) for oxygen, makes it necessary to heat tantalum steel under special conditions that will prevent contact of the heated steel with the air. The electric furnace is mostly used for this purpose. Tantalum ores are rare, and ferro-tantalum (the form in which it is used) is costly.

The effective horse-power of a turbine is determined from the formula: hp. $= \eta \times$ flow of water in lb. per sec. multiplied by head in feet divided by 550, where η is the efficiency coefficient, which varies according to the size and type of turbine. A formula which is based on the relations existing between the head, revolutions of the wheel and the horse-power is: $\phi = \gamma\sqrt{\text{hp.}}/H^{1.5}$, in which $\gamma =$ revolutions per minute, H = head in feet, and hp. the theoretical horse-power. From many tests of wheels there has been derived the accompanying table, which gives the proper values of η in per cent of the theoretical efficiency for the corresponding values of ϕ:

ϕ =	5	10	15	20
η =	78.5	80.8	83.2	84.1
ϕ =	25	30	35	40
η =	83	81.8	80.6	79.5
ϕ =	45	50	55	
η =	78.7	77	75.8	

ORES FORMED BY MAGMATIC SEGREGATION

Written for the MINING AND SCIENTIFIC PRESS
By F. LYNWOOD GARRISON.

Ores of this character may be defined as aggregations of metals and metallic compounds occurring in, or having their origin in, constituents of the igneous or eruptive rocks in which the deposit is found. The fact that eruptive rocks contain metals in various forms is now generally recognized. The old idea of an 'indefinite below' as their primal source appears to be giving place to more logical theories. Moreover, the hypothesis of magmatic differentiation of the rocks themselves from a parent magma is now quite generally accepted by geologists. Thus, for example, it has been claimed in the Tonopah district, Nevada, that the original magma was split by differentiation, first into basic andesite ('later andesite') and silicious dacite, and by a later continuation of the process, into rhyolite and basalt. It is logical to suppose that further operation of the process may produce metallic segregations in the eruptives, sometimes of sufficient magnitude to be of commercial importance.

Some geologists attempt to distinguish between differentiations or segregations which have developed within the laccolith, that is, a magma at or near the surface of the earth, and such as have taken place in the magma when deep-seated, and afterward carried upward by a separate act of eruption. The general conception as to what constitutes a magma appears to be vague. It is ordinarily defined as a molten or plastic material lying beneath the surface of the earth, that is, igneous rock in an unconsolidated or unindividualized condition; it may be in fact regarded as essentially a solution. Van Hise considers that under certain conditions of heat and pressure solids and liquids are miscible, that is, a magma can be at the same locality several different things, varying with the depth and the pressure. Near the surface it may be an intensely heated molten rock-mass holding water in solution, and at greater depths an intensely heated solvent holding rock in solution. Conceived in this way, it is possible to suppose a slowly cooling mass in which minerals and metals can arrange themselves according to Soret's principle, and at the same time we may assume the pressure of the solvents as strong enough to remove or replace certain minerals and to impregnate their skeletons with sulphides, as shown by sections examined microscopically.[1] The forces regulating magmatic differentiation and segregation are obscure, and have not been extensively investigated. Soret's principle may account for some abstruse conditions, since, according to this law, dissolved matter is concentrated in the coolest part of the solution; in other words, molecular concentration may be caused by differences of temperature in a homogeneous solution unequally heated, and concentration will be greatest in the section of lowest temperature. The operation of this law depends upon the fact that rapidity of diffusion is directly proportional to the temperature, and is greater at high than at low heats. Some geologists take the view that a magma may be regarded as a mixture of different liquids, partly insoluble in one another, and that this principle of limited solubility must be considered as a physico-chemical principle governing the differentiation phenomena of silicate magmas in general.

According to Becker,[2] and Harker,[3] molecular flow in cooling magmas is too slow in its operation to cause magmatic differentiation. Both Becker[4] and Spurr[5] contend that the migration and concentration of the first crop of heavy minerals near the borders is to a great extent due to convection currents, resulting from differences of temperature. Park[6] does not consider these hypotheses quite satisfactory, for he contends that in a molten magma confined between walls the direction of the convection currents in its central portion would be upward and outward, and in the outer sections they would be downward and inward. Consequently this cycle of flow would be as likely to form central as border aggregations, or segregations only in the outer limits of the magma. Convection currents, even in a very fluid magma, are slow, except there be a constant accession of heat from below in amount much larger than that which would be normal to the depth. Park believes that there is no evidence of such accession in the case of a magmatic mass forming either a dike or a laccolith. He believes that border-segregation is mainly due to differences of osmotic pressure in the magma, with convection currents perhaps acting as a contributory force.

Osmotic pressure is commonly defined as a force causing an impulse or tendency of fluids to pass through partitions and to mix or become diffused through each other. There can be no doubt that molten rock-magmas are unstable, and tend to break up into more or less distinctly separate magmas, with sharp contrasts in their percentages of silica and base. In other words, as a result of diffusion and differentiation, the original homogeneous molten mass splits into a number of sub-magmas. Hence in one and the same eruptive district, instead of a single form of rock with a constant chemical character we find a number of rocks of varying composition, yet having a family resemblance to the parent type. Prolonged high temperature acting upon a mixed mass of material may furnish conditions suitable for slow aggregation and crystalline re-arrangement, without the melting point being attained. Hundeshagen[7] observed that, in the Dutch East Indies, certain basic diorites appear to form the outer crust of batholiths of granite, and are not due to later eruptions, thus confirming what has been repeatedly observed in other parts of the world, namely, that igneous rocks are often more basic in their outer portions than within the mass. The outer portions of these granites are usually richer in the heavier minerals, such

[1] Browne, D. R. Origin of Secondary Ores. *Economic Geology*. Vol. I, No. 5, p. 467.

[2] *Quart. Jour. Geol. Soc.*, Vol. I (1894), p. 311.

[3] *Amer. Jour. of Science*, Vol. III (1897), p. 21.

[4] Ibid, Oct. (1897), p. 257.

[5] *Trans.* A. I. M. E. (1903), p. 288.

[6] *Trans.* I. M. & M., Vol. XIV, p. 537.

[7] *Trans.* I. M. & M., Vol. XIV (1905), p. 539.

as magnetite and hornblende, than are the inner portions.

Sjögren[8] mentions the remarkable fact that in most of the Scandinavian iron ore deposits of segregative origin, notably at Taberg, the orebody forms the kernel of the mountain, that is, the ore concentration occupies the central parts of the eruptive mass. This is in sharp contrast to the concentrations of the basic constituents of eruptive rocks along the edges or borders of the mass. The concentration of magnesia has taken place, not so much in the ore, as in the concentration-facies between the normal rock and the segregations richest in iron. It manifests itself in the formation of magnesian iron silicates of the olivine and pyroxene groups. A certain percentage of magnesia is found even in the purest segregations of ilmenite in labradorite rock, owing to a mixture with $MgTiO_2$. The alumina left in the final concentrates combines particularly with the magnesia, forming spinel, the creation of which is favored by the relative deficiency of silica in the magma. Attention is also called to the fact that the magnesia-content increases in the first stage of concentration and then diminishes. Although the original magma contains more Al_2O_3 than MgO, the case is reversed in the earlier stages of concentration; in the final product, however, alumina again exceeds the magnesia. It is also to be noted that the chromium and vanadium in these rocks has undergone concentration, while the phosphorus appears not to be so affected to a noteworthy degree. That silica, lime, and the alkalies occur in smaller quantities in the concentrates than in the rock mass, is manifested by the total absence of feldspars from these concentrates. Dikes are frequently more basic, or lower in silica, at the edge than in the centre. During crystallization the metallic base is moved to the coldest portion. Kemp[9] compares these changes to the varying values from the outside to the inside in a solidified ingot of base bullion, and to the variations in chilled pots of copper-nickel-iron mattes. Spurr[10] has repeatedly called attention to the tendency of molten magmas to segregate their highly silicious constituents, and ascribes the origin of pegmatites and quartz veins to this force, the one passing by gradual transitions into the other. The more basic constituents crystallize out first, the process continuing until a sort of acid mother-liquor is left, which eventually crystallizes into pegmatite, aplite (alaskite), and quartz, the least silicious solidifying first, the pure quartz being the last. Spurr's view is that the molten material from which silicious rocks solidify contains more water than do the basic magmas. Therefore, by progressive separation of the more basic constituents, the residual portion of the molten mass becomes more aqueous and more silicious. This would explain the coarse crystallization of pegmatite, which in turn, by the disappearance of feldspar and mica, grades into pure quartz. These rocks show by their structure that they have been deposited from solutions so attenuated they may be considered as highly heated waters with mineral matter in solution. Associated with this water are quantities of highly mobile and solvent elements, such as fluorine, boron, and chlorine, the presence of which in granite and pegmatite is shown by the resulting tourmaline, mica, and apatite; there may also be present valuable metals, which constitute a large proportion of the whole amount contained in the original magma. Spurr's theory assumes that metal-bearing fluids from which most ore deposits are precipitated, must be extreme differentiation-phases of rock-magmas, and that most ore deposits and mineral veins represent one or the other of the extreme products of magmatic differentiation.

Emmons[11] doubts whether igneous magmas as they come from the interior of the earth contain sufficient water to produce these phenomena. Suess[12], on the other hand, takes the affirmative side of the question, dividing hot springs into those in which the waters rise under hydrostatic pressure and those deriving their waters from the interior of the earth, the latter being characterized by intermittence. Kemp[13] takes a view similar to Suess. Scheerer[14], in advocating an aqueo-igneous origin for granite, suggested that owing to the presence of water the magma might cool considerably below the temperature necessary for solidification under conditions of dry fusion, and thus allow minerals which cannot endure high temperatures to crystallize ahead of the less fusible constituents. One of the most conspicuous of such minerals is allanite, an iron silicate of the rare earths cerium, lanthanum, yttrium, didymium, and erbium. It was for a long time considered one of the most infrequent rock-forming minerals, but is now known to be widely distributed, and is sometimes an important accessory. As this mineral cannot stand a temperature above dull-red heat without change of physical character, it was supposed that its presence was conclusive evidence against the igneous origin of a rock. Epidote was also formerly regarded as a secondary mineral, whereas it is now believed to often originate in igneous rocks. Thus, for example, it is now regarded as an original constituent of certain granites in Maryland, where it occurs in parallel intergrowths with allanite.[15] Epidote, regarded as primary in character, has been noted by Lacroix (*Bull.* Soc. Min. de France, XII, p. 139) in certain rocks from Finistère, France, and by Brogger (Zeitsch. f. Kryst., XVI, p. 99) in pegmatites from Arendal, Norway. Allanite and epidote are representatives of a large number of metalliferous and non-metalliferous substances which enter into the constitution of igneous rocks. They indicate how widely metal-bearing components may occur, and how differently they may be found without being of extraneous origin. They also occur as primary minerals under conditions far more ex-

[8]*Bull.* 18, A. I. M. E., Nov. 1907, pp. 922-930-931-932.

[9]*Mining and Scientific Press*, Jan. 19, 1907.

[10]*Trans.* A. I. M. E., Vol. XXXIII (1903), p. 297. *Economic Geology*, Vol. II, No. 8. Dec. 1907, p. 781.

[11]'Ore Deposits', Edited by T. A. Rickard (1903), p. 45.

[12]Suess, quoted by Emmons, Ibid, p. 45.

[13]Ibid, p. 47.

[14]Poggendorff's *Ann. d. Phys. u. Chemie*, Vol. LVI (1842), p. 479.

[15]*Bull.* Geo. Soc. Am., Vol. IV, p. 306.

[16]Keyes, 15th Ann. Rept. U. S. Geo. Survey, p. 705.

traordinary and seemingly impossible than those under which many metallic salts are found.

At this point it is desirable to direct attention to the fact that magmatic segregation and differentiation must necessarily take place before solidification, and that ore deposits derived from the same magma after solidification are not segregations, no matter how they occur. It is reasonable to assume that there may be an intermediate stage, wherein the metallic minerals and metals are attacked by aqueous and other gases before the solidification of the magma, and thus be transported to neighboring solidified rocks to be deposited in them as replacements of the rock itself, or in fissures and cavities that have resulted from earth movements which took place long after the consolidation of the particular magma of which it was a part. Of course, such deposits need not necessarily be confined to eruptive rocks, since the metal-bearing solutions and gases could similarly deposit their burden in the cracks and fissures of sedimentary rocks. It is conceivable that after the solidification of the magmas the metallic segregations therein may be dissolved and leached by waters which would transport the metals in solution to the cracks and crevices in the same or in adjacent rocks, and, upon encountering suitable precipitating conditions, deposit the burden therein. It is evident that this kind of circulation, solution, and precipitation may continue indefinitely as long as water is present in the rocks. The ore deposits thus created cannot well be distinguished from those formed by gaseous emanations; probably in most instances both classes of phenomena act to produce fissure veins and lodes as we now find them. Such deposits, however, are not in any sense segregations, and are only mentioned incidentally, although they are undoubtedly the sources of our most commercially valuable orebodies. Magmatic segregation may have been the first step in their creation, but if the process had stopped at that point, such deposits would probably be too lean or too small to be of importance; experience has shown that in comparatively few instances are primal magmatic segregations of sufficient size or richness to be of economic value. By reason of magmatic differentiation or segregation, some portions of an eruptive are richer in metals than the average of the mass, in other words, magmatic concentration may assemble the metallic minerals in certain definite areas of the rock or magma. Circulating solutions can subsequently abstract these metallic stores, transporting them to other localities where favorable conditions for re-deposition are present, and thus the ordinary and usual form of mineral fissure veins or lodes, which may or may not be further enriched by secondary solution and precipitation of minerals from the upper portion of the lode itself or neighboring deposits.

It is evident that this process of accretion may be repeated many times, which would account, in part at least, for the extaordinarily rich bunches of ore sometimes encountered in veins.

While it is plain that magmatic segregation may assemble metallic minerals in certain circumscribed areas, it does not follow that they are likely to be of sufficient size or richness to constitute ore deposits. Whether a rock is an ore or not depends obviously upon the cost of treatment necessary to extract the metal from it. It seems probable, therefore, that we have in magmas, just as in the vadose circulation, solution and segregation repeated a sufficient number of times to cause an accretion in metallic minerals of a size large enough to form an orebody in a commercial sense. It must be admitted that in both cases much must be left to the conception of the investigator, but only by such deductive reasoning can we ever hope to arrive at a logical working hypothesis regarding these difficult but extremely important matters.

Another factor which plays an important rôle in the accumulation of ore deposits by both magmatic processes and by vadose circulation, is that of magmatic waters. In a highly heated mass, this water must be in the dissociated form, that is, as hydrogen and oxygen, and must be under a high pressure. There is as yet nothing known to indicate how these gases will act upon metallic minerals. Probably with other gases, notably hydrochloric acid, the action would be energetic, as vehicles for the transportation of both minerals and gangue. The ease of such circulation through the magmatic mass is of course greatest while the rock is entirely molten, and will gradually cease as the mass cools and hardens. In this connection Kemp[17] points out that even the crystallization of the rock-forming minerals may be occasioned by the loss of dissolved gases. As the mass congeals the gas bubbles will be more and more hindered in their egress, consequently will attempt to depart along cracks, crevices, and openings. As compared with relatively cold meteoric waters which may later penetrate the rock, the solvent and corroding action of these gases is probably thorough and far-reaching. As far as the leaching action is concerned, the general relation of crevices to the mass must be much the same for both. Kemp observes that the presence of metals in igneous rocks, as shown by assay, proves that all the original contents have not been taken away by either process. He believes an igneous mass may be considered as the source of the magmatic water, even if not of the ores and gangue, and a well established, highly heated reservoir for this solvent is thus provided, at the necessary depths within the earth. Evidently such water takes metals as well as gangue from the parent mass and from the overlying rocks traversed by it. In the upward journey, meteoric waters may mingle with the magmatic, and as temperatures and pressures fall, a preciptation of the dissolved burden takes place, and orebodies are believed to be the result. Gradually the source of the water and its store of energy becomes exhausted, circulation dies out, the period of vein-formation ceases, and the secondary concentration or enrichment through the agency of meteoric waters remains as the only influence to change the character of the ore deposits.

Magmatic segregation is evidently a primary pro-

[17] *Scientific American, Supplement*, No. 1670, pp. 10 and 11 (Jan. 1908). (Presidential Address before N. Y. Academy of Sciences.)

cess, the first phase of a long system of change; its study is therefore of the greatest importance, although surrounded as it is by so many difficulties and obscurities. The theory that all igneous magmas contain water and dissolved metals which, upon ascent of the magma into a zone of lessening pressure, are given off, penetrate the surrounding rocks, and ascend to the surface as thermal springs, is being received with general favor. The results of such action Lindgren[18] classifies as follows, in consecutive order: (1) product of igneous differentiation in the magmas; (2) contact deposits at the point where the volatile substances left the magma; (3) deposits by magmatic waters on their way to the surface at greater or less distance from their point of origin and more or less mixed with surface waters.

Ore deposits derived from magmatic segregation may for convenience be divided into three general groups: (A) native metals, such as gold, platinum, rarely copper, and possibly silver; (B) metallic oxides; (C) sulphides and arsenides. It has moreover been observed that some classes of metallic minerals favor certain rocks, thus titaniferous iron ores are mostly in basic eruptives, such as diabase; chromic iron, nickel, and platinum minerals favor peridotites and their serpentine derivatives; nickeliferous pyrrhotites usually occur in gabbro; and tin oxide is almost invariably found in granitic rocks. It is probable that these various classes of inorganic natural selection may be due to one or the other of two distinct processes of origin. First, by mass-action, and second, by vapors due to aqueous vapor above the critical temperature, that is, the action or force known as pneumatolytic, a process operating subsequently to eruption. By virtue of its direct genetic connection with eruptive conditions, it may be classed as allied to magmatic deposits. By mass-action it has been observed that the heavy minerals concentrate in the bottom of a horizontal eruptive sheet, sinking before the molten mass chills or becomes plastic. This action is chiefly due to the force of gravity, and to some extent to the Gouy and Chaperon's principle, according to which the bases tend to collect toward the outer margin, while the central portion is higher in silica. Sulphides to some extent aggregate in obedience to the law of mutual attraction. There may be a gradual transition from rock carrying little ore to ore containing little rock. Basic (dioritic) rocks gradually merge into acid or granitic rocks. Regarded in the light of experience with furnace slags, acid rocks are those which would naturally chill and solidify first, hence diorites and norites, being highly basic and fusible, would be the last to separate from rock masses. Metallic sulphides tend toward segregation in the basic portions of the magma away from the acid. A fused magma is essentially a solution of a number of different oxides and sulphides. In cooling, the least soluble constituents separate first and tend to concentrate in the coolest portions of the magma, which is usually along the borders of the mass. In an elliptical mass the ends tend to cool most rapidly and the least fusible minerals to assemble and become localized in favorable spots at the expense of other portions of the wall-space. As a rule ferro-magnesian silicates are richer in metals than the other portions of a magma; the metals appear to exist in them either as bases or as metallic inclusives. The escape of sulphurous gases through still molten rock near contacts, tends to produce metallic sulphides wherever they encounter the metals, even though the general conditions of the mass are oxidizing. Such sulphides would evidently be formed in the order of their affinity for sulphur; iron first, then copper, nickel, and so on. It is not difficult to imagine this process taking place in a molten intrusive closely confined by relatively cool rock; the emanating gases passing upward through the fluid magma and restricted to it by the surrounding rock. This idea harmonizes with experience in finding ore thus restricted to the area of a once fluid intrusion.

Kemp[19] states that as a general rule minute quantities of sulphides disseminated through igneous rocks with which they have ascended from the depths of the earth, constitute the most reasonable source to refer all ores except iron. I would suggest that a portion of the sulphides may have been produced by the action of sulphur gases upon native metals in the magma, and that their action may have taken place not only before but after partial or entire solidification. The probabilities are that both conditions obtain and that the resulting orebodies of metallic sulphides were due to a combination of the two forces. To say that the rarity of native metals (except gold) in eruptive rocks substantiates this theory, would hardly hold, as there is no knowing that they were ever present, or that the metals were not always in the form of sulphides.

Derivatives from the peridotites, or ultra-basic rocks, are naturally accompanied by a large proportion of iron, sometimes sufficiently great to constitute an iron ore of commercial importance. A notable example of this kind has recently been developed at Mayari, on the north coast of Cuba, 12 miles south of Nipe bay. Peridotite rocks here appear to be overlaid by serpentine, accompanied by diabasic intrusives. The weathering of the peridotites has resulted in accumulations of large areas of ferruginous material resembling the laterite of India and other tropical countries. Laterite may be described as a kind of nodular ferruginous concretion, formed by the damp heat and decomposing vegetation of tropical countries acting upon basic rocks, especially altered peridotites (serpentine). In India there are several varieties of this material, each having a somewhat different origin. The vesicular or pellety laterite, the class here considered, is formed by the decomposition of the rock in place, and has usually the highest percentage of iron. Whether this material has resulted directly from the alteration of pre-existing iron segregations or is simply the result of a change in the usual rock minerals, has not yet been determined.

The Mayari deposits have so far not been scien-

[18] *Economic Geology*, Vol. II, No. 8, p. 757.

[19] *The Mineral Industry*, Vol. IV, p. 766.

tifically described. They are referred to in the Hayes-Vaughn-Spencer reconnaissance report published in 1901, but their peculiar lateritic character does not seem to have been recognized. Their average composition from a large number of samples is given as follows:[20]

	%
Iron	46.03
Silica	5.50
Alumina	10.35
Chromium	1.73
Phosphorus	0.015
Hygroscopic water	31.63
Combined water	13.63

These ores are said to contain some nickel, which seems probable, considering their origin. They occur in a mantle of thick red clay, from which they will probably have to be washed, although from the description published in the *Iron Age* it is not so stated. Similar deposits exist elsewhere in Cuba, and I have seen something resembling them in Santo Domingo. If found in large quantities in the Greater Antillean Islands they are likely to become an important source of ore-supply for the iron and steel works of the Atlantic seaboard.

Resuming the original subject of this paper, it appears, by reviewing the literature, that the number of workable iron deposits scattered throughout the world the origin of which is probably due to magmatic segregation, is large, especially if the titaniferous ores as a class should be included. It has been repeatedly observed that titaniferous iron ore usually occurs in basic rocks, and that the magnetite of the granites and syenites itself carries no titanium, the little which is formed, often to the extent of 1% or more, being in the form of titanite; the titanium having combined with lime and silica from the body of the magma. With basic magmas the silica has been entirely taken up by the feldspars and ferromagnesian constituents; the titanium has consequently united with the iron and has become concentrated into orebodies by segregation. This rule may perhaps have exceptions, but the concensus of opinion is to the effect that the magnetites of the basic rocks are always titaniferous. Ball[21] regards the titaniferous iron ores and anorthosite of Iron Mountain, Wyoming, as differentiated products of a common magma, the iron having been intruded into the anorthosite after that rock had completely solidified.

As might be expected from their habit of accompanying basic rocks, vanadium, chromium, nickel, and cobalt are frequently present in titaniferous iron ores. Phosphorus and sulphur are usually present in very small quantities, or they are entirely absent. The division of magnetic ores into non-titaniferous and titaniferous agrees, according to Kemp,[22] with their geological relations, the titaniferous being almost always associated with gabbros. The Brazilian deposits and the ores at Alnö in Sweden form exceptions. Here the titaniferous magnetite is usually in the condition of large irregular masses formed by segregation before or during cooling; sometimes the mineral impregnates the rock.

As previously observed, the presence of a large proportion of iron in meteorites is notable; similarly in terrestrial basic rocks a high percentage of iron is sometimes present. It occurs not only in the dark ferro-magnesian silicates but also as oxides and sulphides. Such rocks may contain as much as 15% of iron oxide, hence it is logical to suppose that from the highly ferruginous phases of ordinary basic rocks it is but a short step to a stage where magnetite by selective segregation becomes the principal constituent. Similarly, chromium, nickel, platinum, and frequently copper, appear to have resulted from such selective segregation in highly basic rocks. In general it may be assumed that magmatic differentiation divides the mass into two principal parts, one grading into the other. At the extreme limit of the basic half workable deposits of the aforesaid metals are apt to be found, while at the other, or silicious extreme, we find the acid granites, aplites (alaskites), pegmatites, and quartz veins, which are often auriferous. Admitting magmatic segregation to be a primary process, the thought arises, cannot some light be thrown on this obscure subject by a study of meteorites and meteoric matter? In this class of material there are, of course, certain compounds that are unstable and unknown in the earth, such as chlorides, sulphides, and phosphides, and also some volatile or combustible hydrocarbons. The absence from meteoric material of quartz, feldspars, micas, amphiboles, leucite, and nephelite is notable, and even more so the entire lack of water and hydrates. Unless, therefore, we assume the earth to have been without a hydrosphere and atmosphere at the time of the formation of what we may call the primary rocks, it is difficult to see how similar conditions could exist in these two classes of cosmical bodies, that is, the earth and the meteorites. It is evident, from even a casual study of meteoric material, that segregations of nickeliferous iron have taken place in them and that in many cases this alloy constitutes the bulk of the meteorite. We have no evidence that primary magmas in the earth are homogeneous; the heterogeneity of meteorites is well known, and argues that cosmic material is far from homogeneous. But meteorites vary greatly in this respect, and are evidently polygenic, some having a tuffaceous structure, while others are of so uniform a character that crystallization from a single magma is indicated.

One of the most striking differences between terrestrial rocks and meteoric stone is the absence of silica and water in the meteorites. To assume that the primal rocks in the earth were of similar origin to meteorites, some plausible theory must be found to account for the absence of the quartz and water in the meteorites. Farrington[23] has undertaken this in the following way: "The free silica in the earth's crust is readily accounted for if we remember that the rocks of the earth's crust have been worked over, while in meteorites they are seen in their primitive condition. When silicates are exposed to the action

[20] *Iron Age*, Aug. 15, 1907.

[21] *Bull.* No. 315 (1906), U. S. Geological Survey, p. 210.

[22] School of Mines *Quarterly*, Vol. XX, pp. 325-356.

[23] *Journal of Geology*, Vol. IX (1901), p. 631.

of CO_2 for any length of time the bases change to carbonates and silica is set free."[24] "It seems reasonable to suppose that the vast amount of calcium and magnesium now held in limestone, was originally in the form of silicates. If the CO_2 of the limestones should be withdrawn to the atmosphere, and their bases combined with the excess in silica of the crust, rocks as basic as those in meteorites would probably be formed. The lack of oxygen in meteorites may only be relative, because much of the matter of which they are composed was in the interior, deep-seated, and protected from gaseous action. The superficial lighter silicious portions of meteorites are found to be oxidized. It is reasonable to believe that the earth's substance is not oxidized except in its superficial crust." The rocks of the earth do not seem to have the power of absorbing and holding oxygen as they do other gases. Terrestrial rocks do not contain it, although they hold hydrogen, carbon dioxide, and carbon monoxide in large quantities. The absence of water from the meteorites is an important gap in the parallelism. In the gases hydrogen and oxygen, which meteorites possess, the cosmic body has the elements necessary for the formation of water. The chief reason for the absence of water from meteorites seems to be the fact that the size of the meteoric spheroid was probably not sufficient to enable it to hold a quantity of the free gases competent to the formation of water, or even to retain water-vapor if once formed. The presence in some meteorites of large proportions of the basic silicate minerals, olivine, enstatite, and diopside, is notable. A meteorite from Carcote, in Chile, described by Sandberger,[25] contained 33.83 CaO, 8.40 MgO, and 30.25% KCl, etc. Kislakowsky[26] describes a meteorite containing over 8% of the silicate anorthite ($CaAl_2Si_2O_8$). Iron sulphide is also of frequent occurrence in meteorites in a peculiar form, which has been given the definite name of troilite. It closely resembles pyrrhotite. Common iron pyrite has also been observed in a number of instances. It is evident, therefore, that there are fundamental resemblances between certain kinds of metoric material and some of our basic rocks. Even if the planetismal hypothesis be accepted, we are not justified in assuming that our present basic rocks represent the primordial material from which eruptive and extrusive rocks in general were differentiated. That all such rocks as we now know are phases of an original approximately homogeneous magma is a postulate which appears to be meeting with general acceptance by advanced geologists.

The density of the earth is perfectly consistent with the planetismal hypothesis of Chamberlin; which is, in brief, that the earth was originally an aggregation of meteoric material. Even some of the stony meteorites are brecciated, showing that they are probably built up from fragments of larger bodies. Some students assume that stony meteorites correspond in both composition and structure to the comparatively shallow fracture-zone of the earth, while the nickel-iron phase represents the barysphere, or heavy core, beneath the crust. There is no evidence that the primary magma of the earth was homogeneous; on the contrary, if we accept the planetismal hypothesis, the well known heterogeneity of meteorites would tend to indicate that cosmic materials are far from uniform or homogeneous in character.

[24] *Pro.* Royal Soc. of Edinburgh, 1890-91, p. 229.

[25] *Jahrbuch für Mineralogie* (1889), Vol. II, pp. 173-180.

[26] *Bulletin* de la Société Impériale des Naturalistes de Moscou, Vol. IV, p. 187.

The Prospector.

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W. S. L., Silver Peak, Nevada: Garnet.

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M. F. B., Boston, Massachusetts: Quartz lens in gneiss or schist with pyrite and chalcopyrite.

W. F. C., Battle Mountain, Nevada: Massive fine-grained kaolin aggregate with copper stain.

J. McG., Greenwater, California: No. 1, much weathered acid volcanic breccia; No. 2, rhyolitic obsidian.

D. H. M. Co., Nespelem, Washington: No. 1, chert nodule (?) or quartzite; No. 2, limestone; No. 3, granite; No. 4, granite or coarse aplite.

R. B., McKittrick, California: No. 1, nondescript porous rock charged with a hydrocarbon which distills and yields inflammable gas; No. 2, calcite and kaolin; No. 3, kaolin and little calcite in apparently weathered volcanic rock.

A. T. T., Arizpe, Sonora, Mexico: No. 1, quartz porphyry; No. 82, basalt, or possibly basic andesite; No. 85, metamorphosed andesite; No. 86, andesitic trap or basaltic trap; No. 102, pyritized rhyolite porphyry; No. 103, pyritized rhyolite.

R. McM., Bouse, Arizona: No. 1, syenite or diorite; No. 2, felsitic rock, perhaps andesite; No. 3, quartz-porphyry; No. 4, biotite gneiss; No. 5, altered rhyolite; No. 6, quartz-mica schist; No. 7, pyrite in acid fragmental volcanic rock. All specimens too small for satisfactory determination.

H. L. M., Hachita, New Mexico: No. 1, quartz porphyry; No. 2, altered rhyolite or dacite porphyry; No. 3, coarse grained feldspathic sandstone; No. 4, quartz-garnet schist; No. 5, rhyolite; No. 6, carbonaceous shale, almost graphitic; No. 7, arenaceous shale with some calcite; No. 8, quartz rock with some calcite.

A. F. F., Los Reyes, Jalisco, Mexico: No. 1, hornblende schist; No. 2, gabbro; No. 3, amygdular andesite; No. 4, hematitized rhyolitic or andesitic porphyry; No. 5, gneissose granite; No. 6, weathered rhyolite; No. 7, garnetiferous quartz-rock, contact phase; No. 8, quartz porphyry; No. 9, nodule of magnetite and hematite.

CONTINGENT FEES.

At a recent meeting of the New York section of the Mining and Metallurgical Society of America the following expressions of opinion were submitted:

F. F. Sharpless.—When the present question was proposed for discussion at the meeting of January 14, it brought quick and positive answers, but as discussion progressed it became evident that the positive answers needed modifying clauses. On giving the subject a little careful consideration it becomes evident that there are occasions when a contingent fee is highly proper and other occasions when one is equally improper. But, before trying to classify these it is advisable to define what is meant by a contingent fee. The Century dictionary definition of contingent as applied to fees is unsatisfactory, and it is doubtful if a definition can be formulated which will cover the point to the entire satisfaction of all our members.

Subject to modification, I would suggest that contingent fee is a remuneration in which time and amount depend upon the actual or anticipated success of the business resulting from the services for which the fee is rendered.

This definition apparently covers all kinds of contingent fees that were specifically mentioned in the sundry examples spoken of during the discussion; it includes that fee which is proposed as a bribe in order to get a highly colored report on a questionable undertaking, as well as an unpromised honorarium given to an employee for exceptional services well performed.

At first thought 'contingent fee' suggests a bribe. We immediately think of someone offering us a fee of large amount for a report on a property, provided the report is favorable, but the 'someone' can pay only a small amount if the report be unfavorable. There is no doubt in the mind of any member of the Society what should be our stand in respect to a bribe, and it seems superfluous that the members should even take a vote or go on record in regard to anything so obviously immoral.

Carrying the thought to the opposite extreme, we see that an honorarium is a fee paid contingent upon the results of exceptional advice or services rendered of some kind, but it too must be included in the above definition. In this case also I think our members are all of a mind as to the wisdom of accepting or giving a contingent fee. It can do no harm morally or otherwise to the recipient or donor, it is a mark of appreciation for services rendered and it may be considered as fully earned, and further it is a fee that could have been earned in no other manner. It is a merited reward for the use of brains.

Between these two extremes there are contingent fees of many types, many individual cases were pointed out, and we can think of many more that are supposable, differing from each other to such slight extent that they can scarcely be put into classes. They shade from the true reward for honest services, by almost imperceptible differences, to the bribe for a misstatement of facts.

A type of contingent fee that is common at the present time, both in the United States and abroad, contemplates the steady employment of capable men under a rather modest fee, with an understanding that they will participate with their employers in the profits of any business resulting from the efforts of the employee. This type of a fee is advantageous to both employer and employed. The employer can keep a greater number of men in the field, cover greater territory, and get in touch with more possible business; good men can accept this kind of a fee and remain in active work with ample reward for successful services, whereas if they felt that they could accept only a stipulated but larger fee they could not be so employed continuously and the larger reward for exceptional services would not be paid. Men whose wide experience and ability are in great demand may not care for such fees, but it scarcely seems that a moral point is involved in the transaction, or that men whose services are in less demand should refuse them.

Fees in the shape of stock interest are sometimes paid, fees that may be regarded as contingent because their value is contingent upon certain eventualities and these will be proper or improper to accept depending upon the conditions under which they are offered and accepted.

The case of an officer, a director or higher official, of a company giving a report to the public as an engineer, was discussed in this connection, it being suggested that the advance in value of stock holdings, promoters' or founders' shares, were a species of contingent fee and that the propriety of such a report could be questioned. It is certain that an officer posing as an engineer and giving information to his stockholders, or to the public, is assuming greater responsibilities than officers of companies usually assume, but if so fortunate that he is capable of doing this it is rather to be commended than discouraged, and the propriety or impropriety of the procedure must be determined by the circumstances of the case.

Almost an endless variety in the forms of contingent fees might be cited, and it seems scarcely possible to lay down a hard and fast rule regarding those that can be classed as proper or improper fees. The conditions surrounding each case, the conditions under each contract, must be understood and appreciated to judge of its propriety.

The questions asked may be answered in a broad way as follows: A contingent fee may be accepted when its acceptance is known of by all parties interested and when it can in no way involve the question of the integrity of the party receiving such fee, and should not be accepted when unknown to any interested party or when the question of integrity can possibly be raised.

While this answer is broad, it will not satisfy many of the instances which may be called to mind, so much depends upon uncertain factors and the personality of the man who makes the decision. In fact, it seems scarcely possible to form a completely satisfactory direct answer to the question. Would it not be better for us to say that in the opinion of this section every engineer must decide for himself in

what circumstances and to what extent he can accept a contingent fee, and must decide when the occasion arises to make a decision? The members of this Society are presumed to be of normal mental capacity and capable of deciding between wrong and right, so that it is superfluous to advise them to be honest. I think it may be taken for granted that every member of the Society will refuse to accept a contingent fee when it is evidently a case of bribe or when his integrity might be questioned by accepting such a fee, and on the other hand, he will be entirely satisfied with his moral position without consulting the Society when he knows that in accepting a contingent fee he has done no possible harm to anyone.

We can be equally sure that when a case arises where there is a possible or probable question of propriety, that the responsible engineer will take the safe path, even though it be to his pecuniary disadvantage, without any suggestions from us. It is equally sure that the irresponsible engineer will take the opposite course, and will do it in spite of any instructions from this Society. In other words, responsible members of this Society will not need a set of rules to guide them on a strictly moral question, and we are not making rules for irresponsible members, for we do not propose to have them of our number.

George C. Stone.—Contingent fees may be divided into two classes. In the first, the conditions under which the fee is to be paid are such that one might reasonably suspect that the judgment of the recipient might be influenced by the prospect or desire of obtaining it. Such fees are obviously improper. Those of the second class are conditional on the results obtained in work—under the supervision and control of the recipient, and are proper. In the first class, if the recipient is influenced in his judgment, statements, or acts, it is possible that such influence may cause injury to someone. In the second class, any influence exerted by the fee cannot possibly injure anyone.

Perhaps the best definition of what contingent fees are permissible and what are not is, if it is possible that the effect of the fee can injure anyone it is not permissible, while if it cannot do injury to anyone it is. This definition seems to me broad enough to cover all cases, and specific enough to be applicable. The whole question is one of morals, and the basis of any system of morals is that acts that are likely to cause injury are not permisible. This is sometimes modified by the question of the greatest good to the greatest number, but this does not affect the present question.

W. R. Ingalls.—It seems to me that we must discriminate between—first, the engineer acting in a consulting capacity in the strictest sense of professional practice, and second, the engineer acting in a declared, known, and recognized partnership or association with a syndicate or company. An engineer acting in the latter way may with perfect propriety receive for his services a conditional or contingent remuneration in any form and manner that he sees fit, his conduct being governed only by the ordinary rules of business honor. This idea of partnership may be the decisive factor in determining the ethics of this question. There are many cases when the acceptance of a conditional or contingent fee is undoubtedly proper. For example: A (an inventor) may say to B (an engineer), "If you will successfully prosecute my application for a patent, I will give you an interest in it, and obtaining it will promote a company to buy it." B gives services for which his remuneration is dependent upon his accomplishing a certain result, but no one would question the propriety of his doing so. He becomes a partner with A and is entitled to his share of what may be realized from the subsequent promotion. If, however, he should conceal his interest and should make a report for A to use, he would act improperly. Consequently the saving conditions in this case are (1) partnership, and (2) declaration of it. On the other hand the engineer who is acting in a purely consulting capacity ought not to accept a contingent fee. Continuing the same illustration, if A should say to B, "I am negotiating the sale of my patent and want you to make a report upon it; I will pay you a certain amount if the sale is made," it would be manifestly improper for B to do so. B would lack the element of partnership. Even if A should give to B an interest in the patent, B would commit a breach of professional ethics by making a report without declaring his interest. Of course it is not a contingent fee when the engineer is paid immediately in cash, or property equivalent thereof, or with a promise of same that is not conditional upon anything.

J. Volney Lewis.—A contingent interest or profit, whether known technically as a fee or not, is justifiable only when and to such extent as (1) it is fully understood by all interested parties, which in most cases includes the public, or (2) when it is in such form that no personal profit or advantage could possibly accrue from the submission of a biased report.

A professional report whose author is avowedly connected with the enterprise is received by the public in the light of such connection, and will have more or less weight according as the author's reputation for integrity and freedom from bias is more or less firmly established. His professional standing, however, is jeopardized to a far greater extent than if the report had been made in an entirely disinterested capacity, and failure to make good entails a correspondingly severe penalty. In the latter case it merely weakens confidence in his professional judgment, in the former it strikes a blow at his reputation for personal integrity.

The second clause of my opening statement would prohibit the acceptance of any payment, whether a definite sum or a share in the profits, which is contingent on anything but the actual exploitation of the mine. It precludes the acceptance of stock not publicly avowed, unless such stock is placed in trust or otherwise made non-transferable and unprofitable until such time as successful operation is assured. It permits every proper inducement for the engineer to work for the highest success of the mine, but forbids his participation in profits accruing from the sale of the property or financing of the enterprise or from

transactions in the stock market before the mine has been fully established.

Whenever the possibility of profit from a biased report exists at all it will prove a temptation, and therefore a danger, to some, and many will find in it an excuse for the imputation of evil motives when the fact is eventually made known to the public. Such transactions are therefore to be placed in the dubious class in all cases, and should not receive the sanction of the Society.

H. S. Munroe.—The question of the acceptance of a contingent fee or of an interest in a mining property by a mining engineer is one that cannot be covered by any simple rule of conduct, but involves a wide field between the one extreme of a bribe for a favorable report upon a doubtful property, to the other extreme of a legitimate scheme of profit sharing in which the contingent fee takes the form of payment for success in operating mines or works. Between these two extremes we have a large debatable ground with infinite gradations, in which it is difficult to draw a sharp line between doubtful propositions and those which are perfectly right and proper. Possibly the situation may be made clearer by considering a few typical cases.

A contingent fee or interest, which is intended to encourage or reward skilful management of mines or works is a form of profit-sharing by which the engineer cannot be placed in a false position even if he fails, except so far as he assumes some added responsibility as part owner as well as manager.

In an ordinary mine examination for a purchaser, the mining engineer may be considered to act in a judicial capacity and is in a position to give an unbiased and impartial judgment on the value of the property based upon the evidence that may be obtained in his examination. Some engineers decline to put themselves in any other position than this and refuse to make reports for owners of mines or for promoters interested in the sale of mining properties. An engineer reporting for a purchaser may without impropriety accept from him an interest in the property in lieu of all or part of his fee.

On the other hand, an engineer making a report for an owner or promoter, who may desire to sell a property and who wishes to use the engineer's report for the purpose of effecting such a sale, may be equally impartial and unbiased and may not be influenced in the least degree in his examination or report by the interests or desires of his clients. It is to be assumed that this will be true of the majority of mining engineers. Nevertheless an engineer making such a report appears before the public in the position of a paid advocate, aiding the owner or promoter to dispose of the mine, and his report therefore commands less confidence than one made in the interest of a purchaser. If the engineer is known to be a man of integrity and good judgment, his report even in the capacity of a paid advocate may be accepted at its face value. If, however, the expert is unknown or of less reputation, the statements made by him will not be accepted without question and will be assumed to represent only the most favorable view of the situation.

If now we push this illustration one step further and assume that the engineer openly allies himself with the promoter by accepting an interest in the sale of the property, he puts himself distinctly in the advocate class and he can no longer be assumed to occupy a perfectly judicial or impartial attitude. He becomes then a man interested in effecting the sale of the property, but on a perfectly legitimate and proper basis as part owner or promoter. In this position we may assume that the engineer desires to maintain his reputation for integrity and ability and that he will not permit himself to be associated with, nor will he allow his name to be used in, enterprises of a doubtful character. Indeed as a business man this will be forced upon him, as he is likely to injure his reputation by the failure of such enterprises. Such a position is one of great difficulty and demands business and professional qualifications of a high order. An engineer in this position cannot afford to recommend a property unless the risk of failure is practically nil. Such properties are rare.

If we pursue the illustration a step further and assume that the engineer conceals his connection with the company and poses as an independent and unbiased expert, purporting to act for the purchasers rather than for the promoters, or if he uses his reputation to aid in the sale or flotation of doubtful properties, we pass at once into the domain of fraud.

Unfortunately this line is not a sharp one, and it may happen that an engineer will be drawn insensibly into false positions and be led to countenance schemes that are more than doubtful. A report originally made for a purchaser may be used by that purchaser to promote the subsequent sale of the property. The interest which has been given him by the owner or promoter in case he has allied himself with them in a perfectly proper business relation, will not ordinarily give him power to control in any way the subsequent operations at the mine or the manipulations of the stock by others interested with him. This is a risk which is taken by all business men in partnership relations. It is always difficult to be certain of the absolute honesty and integrity of men with whom we may associate ourselves in such relations.

To sum up the matter then, it is clear that the acceptance of any fee or interest in a mining property that is likely to render the opinion of the examining engineer less impartial will tend to lessen the value of such opinion in the mind of the public and may lead him into a false position, if not into association with doubtful or dishonest practices.

Contingent fees are therefore to be judged in every case by the simple test of their effect upon the engineer himself and upon his position with regard to the investing public. If the engineer is placed in a false position in any degree, the contingent fee or interest must be considered as doubtful or dangerous, if not absolutely dishonest.

Aluminum, often used in the manufacture of ordinary steels as a purifier during the making process, does not appear to add any desirable quality to high-speed steel, and so far as can be learned is not much, if at all, used in its manufacture.

COMPANY REPORTS.

The British South Africa Co. has just issued its report for the year ended March 31, 1908, bearing imprint of February 26, 1909. With such deliberation a well-matured statement would seem to be inevitable. The company's position is in fact presented with all the skill of a diplomatic body. This is not to be criticized in a corporation vested with functions of civil administration. It is interesting to note the steps which are steadily trending toward political union with the other South African colonies. The population is growing very slowly, the number having risen from 487,200 in 1901 to 662,800 in 1907, but the increase in wealth per capita has grown enormously. In mining a notable advance has been made. In 1900 the gold output was only £308,249. This grew steadily and rapidly, taking great leaps in 1905 and 1906, until the year 1908 showed a production of £2,526,007. The production of other metals was, silver 729,103 oz., diamonds 7020 carats, copper 220 tons, lead 3630 tons, chrome iron 25,021 tons, wolframite 60 tons, scheelite 40 tons, asbestos 55 tons, antimony 14 tons, zinc ore (coming from northwestern Rhodesia) 13,156 tons, and coal 586,729 tons. This reveals possibilities of a varied mineral industry of the kind suited to large expansion of manufacturing as the country develops. The gold mills operating in Rhodesia contained an aggregate of 1488 stamps, and 5 tube-mills, and the ore crushed amounted to 1,612,453 tons. Tailing treated was 651,326 tons. The total gold recovery from this tonnage was 612,052 oz. The 30% interest of the British South Africa Co. in the shares of mining companies has been abolished, and a royalty on claims working at a profit is substituted. Companies organized in the past are entitled to re-organize under the new regulations. The negotiations for the extension northward of the Rhodesian railway system have been concluded. Arrangements have been made for the construction of the Rhodesian section by a contract with the Tanganyika Concessions, Ltd. This railroad corporation will have the title Rhodesia-Katanga Junction Railway & Mineral Co. Work has already begun. Great activity is anticipated in northwestern Rhodesia when the railroad reaches the Bwana M'Kubwa copper mine. The gross revenue from the existing railroad showed an increase of 18% during 1908. The Company goes bravely on facing continual deficits which the future may redeem. The shortage of revenue over expenditure for the fiscal year under review amounted to £152,889.

PITTSBURG SILVER PEAK.

A report for the year ending December 31, 1908, has been issued by the Pittsburg Silver Peak Gold Mining Co., whose mining property is at Blair, Nevada. William Flinn, of Pittsburg, is president and George T. Oliver is vice-president. The general manager is George O. Bradley, a man of first-rate reputation, whom we do not hold responsible for the character of the report, the defects of which must be debited to the directors. Indeed this annual report is a good example of what such a document should *not* be. No statement is made of the number of shares in the incorporation, no facts are given as to ore reserves, nor is even a profit and loss statement attached to the meagre accounts. According to the figures given, 105,670 tons of ore were milled in the 12 months, for a yield of $848,713, out of which $499,789 is deducted for operating expenses, leaving a profit of $348,923. The statement of liabilities is confusing, but it is inferred that a net liability exists of $459,213. With a monthly profit of $35,000 this will be wiped out in a little over a year. From other sources we learn that the capital of the company is $3,000,000 in $1 shares.

MINES COMPANY OF AMERICA.

This report is the first annual statement issued by the company, of which John Lambert, of Chicago, is president and George A. Schroter, of Denver, consulting engineer. The company controls the Creston-Colorada mines at Minas Prietas, in Sonora, Mexico, and also has an interest in the Dolores, in Chihuahua. The report is not signed and it is an unsatisfactory document as a medium of information to shareholders. While it is stated that "within the past two years costs per ton have been reduced from $10 to about $6.50," the financial statement shows that in 1908 the mill crushed 79,200 tons of "rock" at an expense of $814,820, from which it is obvious that the cost was over $10 per ton. What is "rock" anyway? From the monthly reports it is apparent that a large part of the material fed into the mill is old tailing, and as this has been already mined and crushed the cost of treatment should be slight, thereby reducing average costs, in a manner that might be misleading without an explanation. For instance, two years ago the ore reserves were estimated at 83,000 tons, since then 140,000 tons have been crushed, and yet the report shows 90,000 tons available. How much of the 140,000 tons was old tailing? According to the report the profits for the year ending September 30, 1908, were $540,794, while the dividends paid during 1908 aggregated $600,000. Up to date the company has paid $3,385,000 in dividends.

LIBERTY BELL.

According to the report for the year ending September 30, 1908, the Liberty Bell Gold Mining Company did well. The president is Arthur Winslow, of Boston, a mining engineer and geologist of high reputation; the local management in Colorado is in the hands of Charles A. Chase, consulting engineer, and Edward H. Nutter, superintendent. The mine is in the high ranges above Telluride, Colorado, and the company is one of the most successful engaged in the exploitation of low-grade gold ore. The report for 1908 shows that an increase of tonnage and a diminution of costs characterized the operations, which were also marked by an improvement in the grade of ore; thus good management was aided by good luck. The Company paid dividends at the rate of 12% on the capital issued.

Proceeding to details, we find that 116,353 tons were milled, at a cost of $6.07, as against $6.45 in 1907. The receipts were $874,428, or $7.51 per ton, as against $7.25 in 1907. The profit was $167,952, or $1.44 per ton, as against 80 cents in 1907. The cost of mining was $3.13 per ton, of which 63 cents was for development; tramming cost 36 cents and milling $1.88. Under milling expenses, we note 4 cents for crushing, 13 cents for concentrating, 25 cents for stamping, 5 cents for amalgamating, 7 cents for regrinding, 10 cents for settling and agitating, 8 cents for filtering, 8 cents for precipitating, 2 cents for pumping, 37 cents for cyanide, 6 cents for lime, 5 cents for assaying and melting, 3 cents for heating, 2 cents for lighting, 13 cents for depreciation at the rate of 5%, 25 cents for maintenance and repairs, 1 cent for lubricating, 4 cents for tests, 1 cent for watchmen, and 2 cents for superintendence. These many and varied items emphasize the diversity of the processes and apparatus employed in a cyanide plant.

Changes in Foreign Postage.

Changes have been agreed upon in the postal regulations between the United States and foreign countries as follows: between the United States and Australia, the Netherlands, Belgium, and Norway—limit of weight on parcels-post packages, 11 lb.; limit of value, $80. Rate here for packages to these countries, 12c. for each pound or fraction, and payment is compulsory.

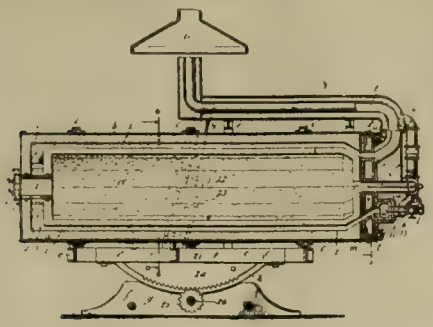
Between the United States and Austria or Italy—limit of value, parcels-post package $80, instead of $50, weight limit remaining at 11 pounds.

From Great Britain and Ireland or Germany to the United States—limit of value, parcels-post package, $80 instead of $50, weight limit remaining at 11 lb., but parcels not exceeding 11 lb. will be admissible to these countries from the United States, without regard to value.

Letter postage on mail exchanged between the United States and Newfoundland will be 2c. per ounce or fraction thereof; unpaid or short-paid postage to be collected at double rates from the addressees.

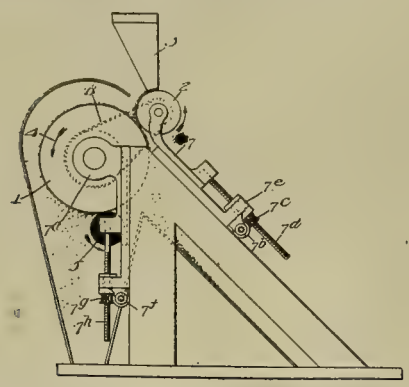
MINING AND METALLURGICAL PATENTS.

UNIVERSAL ORE-TREATING FURNACE.—No. 912,394. Chauncey C. Medbery, New York.



A furnace, comprising a cylindrical retaining shell, a refractory lining therefor forming a continuous interior cover for its ends and longitudinal portion constituting a closed ore treating chamber, flues formed in and extending through the refractory lining, means at one end of the chamber for supplying fuel under combustion to some of the flues in the lining, and a discharge opening at the same end of the chamber through which the products of combustion pass from other of the flues.

ELECTROMAGNETIC ORE-SEPARATOR.—No. 912,363. Thomas Charlton, Chicago, Illinois.



In a magnetic ore separator, the combination of a magnetic roll constituting one pole of a magnet, a second magnetic roll constituting another pole of the magnet, means for rotating said rolls in the same direction, the axes of said rolls being arranged in an inclined plane with the adjacent periphery of the upper roll situated over the other and lying in a vertical plane cutting the periphery of the lower roll at a point between the vertical and horizontal diameters of the latter said roll, and means for depositing the material to be separated between the rolls, the rotation of the lower roll with respect to the upper roll being such that the values will be carried by the lower roll away from the upper roll and in upward direction.

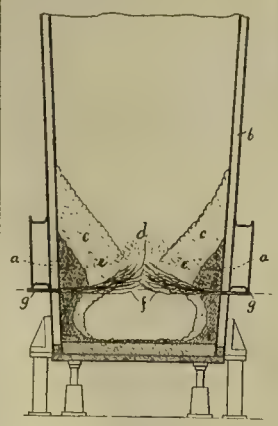
METHOD OF SMELTING ORES.—No. 913,655. James T. Carrick, Johannesburg, Transvaal.

In ore smelting processes, the step which consists in burning gaseous or finely comminuted solid fuel under pressure in the reverberatory furnace at the time of tapping the smelting products, and simultaneously checking the draft, whereby flame or heated gas is caused to issue with the smelting products and access of cold air during tapping is prevented.

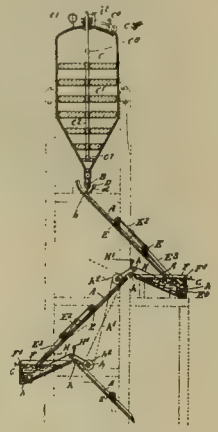
PROCESS OF OBTAINING NICKEL FROM SILICIOUS ORES.—No. 909,666. Edgar F. Price, Niagara Falls, New York.

The process of producing ferro-nickel, which consists in electrically smelting a charge containing a silicious ore of nickel and iron and carbon, by establishing and maintaining an electric arc within the charge, and surrounding the zone of reduction and protecting the electrodes from atmospheric oxidation by a considerable body of the charge.

PYRITIC SMELTING.—No. 912,540. James T. Carrick, Johannesburg, Transvaal.



No. 912,640



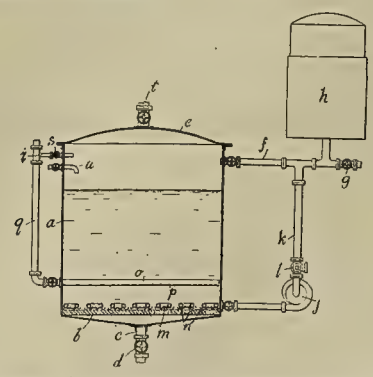
No. 912,783

In pyritic smelting, the process of producing in the furnace at the base of the focus region of slag formation, a restricted zone having a temperature higher than that of the rest of the furnace by injecting combustible at that point and effecting its combustion within the furnace, for the purpose stated.

APPARATUS FOR SEPARATING ORES BY FLOTATION.—No. 912,783. Auguste J. F. de Bavay, Kew, Victoria, Australia.

In an apparatus of the class described, the combination of a feed pipe, a rotary worm therein, an ore supply connected to each terminal of said pipe, a water supply pipe arranged parallel and adjacent to said feed pipe, a plurality of inclined chutes, distributing means extending transversely of each chute, a liquid containing receptacle at the lower end of each chute, provided at one side with an adjustable overflow lip and inclined gutter for receiving and conveying the particles capable of flotation, an endless traveling belt in each of said receptacles having one end submerged therein and adapted to convey the heavier constituents from one trough to the succeeding inclined chute, spray pipes adapted to deliver water upon the belts after they have emerged from said receptacles, and operating means common to said distributing means and said endless traveling belts.

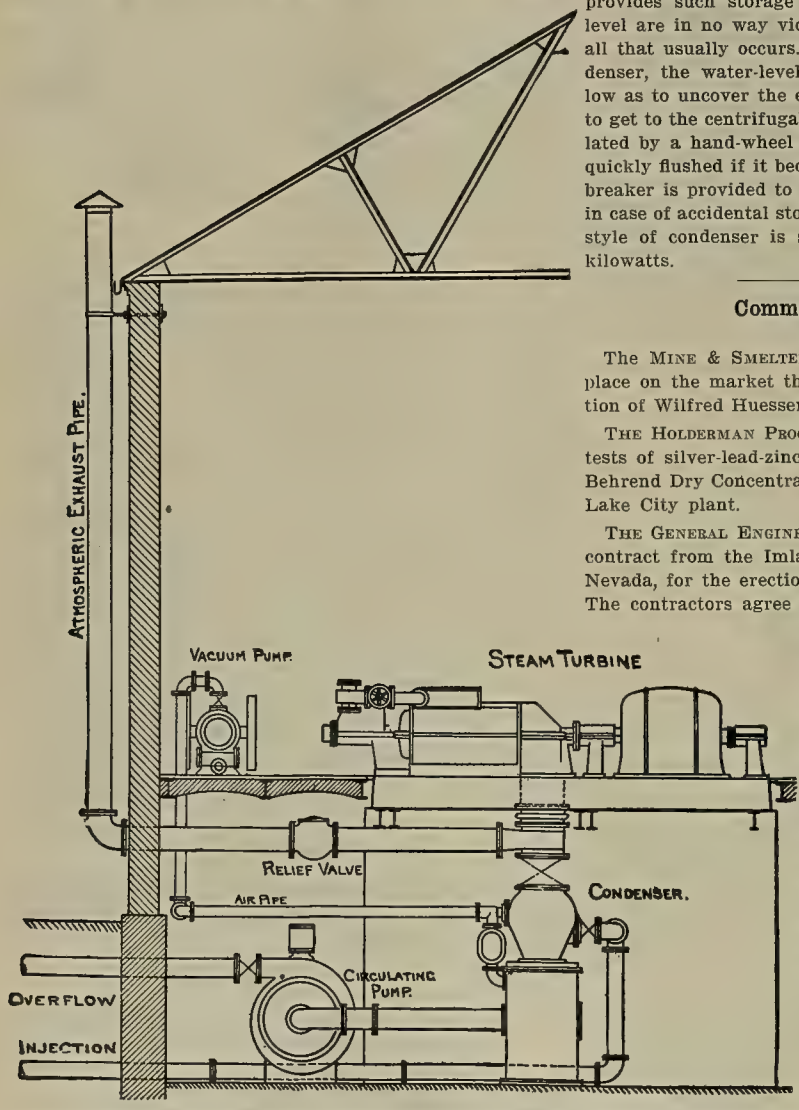
AGITATING AND SEPARATING MIXTURES OF SOLID MATTER AND LIQUIDS.—No. 912,541. James T. Carrick, Johannesburg, Transvaal.



The process which consists in treating matte with a suitable liquid to generate gas, agitating the mass during digestion by injecting the necessary quantity of said evolved gas into the same, and subsequently drawing off the liquid through a filter medium while maintaining the mass in proximity to the filter in a state of agitation by means of gaseous jets.

Centrifugal Jet-Condenser.

A jet-condenser is recommended for situations where the cooling-water is fresh and suitable for boiler feed, or where a fresh supply of good water can be had. The accompanying illustration shows a Cameron centrifugal jet-condenser arranged to operate in connection with a steam turbine. This arrangement is patented, and was designed to overcome certain difficulties found in other types of jet-condenser sets. The condenser cone is mounted on a tank or hot-well, and is placed on the basement floor underneath the turbine, and directly in line with the turbine exhaust-opening. As the cooling-water flows to the condenser



spray-nozzle under suction due to the vacuum, it is essential that the injection-water opening be located not more than 20 ft. above the surface of the water-supply. The incoming steam meets the water-spray, and mingling with it, is condensed and falls into the hot-well, from which it is pumped out by a centrifugal pump. The air and non-condensible vapors are removed by a dry-vacuum pump conveniently situated. In an apparatus of this kind the cooling-water must not flow into the condenser faster than the centrifugal pump can pump it out, or the condenser will flood; nor, on the other hand, should the centrifugal pump empty the condenser so much faster than the cooling-water enters, for if it does, it will be pumping a mixture of water and air and is liable to accumulate air in its impeller and become air-bound, or in other words, lose its suction, in which event the vacuum will be lost. To overcome this difficulty there is provided a hot-well in which to submerge the centrifugal pump suction-pipe by carrying it down inside the hot-well to the bottom. The water-level in the hot-well under normal operating conditions is carried at about the centre of the centrifugal pump. Should the quantity of cooling-water be increased, the water-level in the hot-well will rise and result in an increased head on the centrifugal-pump suction and cause the water to flow faster to the centrifugal pump. A decrease in the quantity of cooling-water lowers the level and checks the quantity flowing. The centrifugal pump is therefore self-regulating, having an increased capacity as the water-level in the hot-well rises, and a decreased capacity as it falls. The hot-well provides such storage capacity that these fluctuations in level are in no way violent. A rise and fall of one foot is all that usually occurs. With 28 in. of vacuum in the condenser, the water-level in the hot-well cannot become so low as to uncover the end of the suction-pipe and allow air to get to the centrifugal pump. The injection-spray is regulated by a hand-wheel on the side of the cone, and can be quickly flushed if it become clogged with trash. A vacuum-breaker is provided to prevent the condenser from flooding in case of accidental stopping of the centrifugal pump. This style of condenser is suitable for units from 300 to 8000 kilowatts.

Commercial Paragraphs.

The Mine & Smelter Supply Co. will manufacture and place on the market the Huesser assay balance, the invention of Wilfred Huesser of Salt Lake City, Utah.

The Holderman Process Co. has made some satisfactory tests of silver-lead-zinc ore from Pioche, Nevada, with the Behrend Dry Concentrator which was installed in their Salt Lake City plant.

The General Engineering Co., Salt Lake, has received a contract from the Imlay Mining Co., of Humboldt county, Nevada, for the erection of a complete concentrating plant. The contractors agree to run the plant for a probationary period and turn it over to the owners in complete running order.

The Chicago House Wrecking Co., Chicago, has just published a new 500-page catalogue, including all sorts of machinery, hardware, rope, pipe, tanks, tanks, lumber, and building material. This concern makes a specialty of procuring its stock in large lots, such for instance as the purchase of complete expositions, and at Sheriff's or Receiver's sales, and hence can sell both new and second-hand goods at exceptionally low prices. This catalogue will be sent to anyone interested.

Catalogues Received.

The Allis-Chalmers Co., Milwaukee, Wis., in its bulletin No. 1425 presents the line of perforated metal which it is prepared to furnish.

The Joseph Dixon Crucible Co., Jersey City, N. J., in a small booklet, 'Air Compressor Lubrication', discusses the advantages of graphite over oil for lubrication of air compressors.

The Western Electric Co. is distributing a small pamphlet containing six excellent photographs of President Taft using a telephone. The object is, of course, calling attention to Western Electric telephones.

The Keuffel & Esser Co., Hoboken, N. J., announces that its 1909 catalogue is ready for distribution. This is the 33rd edition of the catalogue of this well known firm, and is the largest yet published. It contains 540 pages and is copiously illustrated. Every user of engineering instruments or drawing materials should have one.

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EDITORIAL.

WE TAKE PLEASURE in stating that arrangements are in progress for the publication of a monthly mining magazine in London and in connection with the organization of the MINING AND SCIENTIFIC PRESS. This new magazine will compete with no periodical already in existence because it will perform a service that no existing paper fulfils. The readers of this paper will receive further particulars at an early date.

THE TIDE of migration is turning northward, the mining engineers and managers who came south for the winter are returning to the scene of their labors, with a view to preparing for the summer campaign of 1909. All signs point to a busy time in the Yukon and Alaska.

RESUMPTION of immigration from Europe upon an unprecedented scale betokens a belief that conditions in the United States are improving. Italy is the chief contributor, probably in consequence of the disasters that destroyed several of her southern communities. America is a melting pot of nationalities, and if the product is not all refined gold, most of it is serviceable metal.

SALOME is the name of the latest mining excitement. Rich gold ore is reported to have been found on the western end of the Harcuvar mountains, in Yuma county, Arizona. Prospectors are hastening thither. Instead of John the Baptist's head on a charger, they expect to see chunks of gold in a pan. If the new camp has the temperament of Mary Garden, it ought to prove an interesting locality.

A WORD of warning is always in order, and in the case of entrance into a foreign country for the purpose of making investments it is well to be reminded that unfamiliar conditions will be met, which necessitate the guidance of men acquainted with the local laws and customs. The article by Mr. F. J. H. Merrill on 'Protection of Mexican Investors', appearing in this issue, will serve to point out certain pitfalls that threaten the unwary. These matters do not imply the existence of unusual difficulties, but emphasize the fact that a knowledge of the law in one country will not suffice as a basis for operation in another. The Mexican laws guarantee the security of property-rights as fully and justly as our own. Concerning the mining laws no less an authority than Judge Curtis H. Lindley says, in his 'American Law Relating to Mines', "The existing code of that Republic is a substantial departure from the old order of things, and furnishes the best example of a liberal and progressive system of mining

laws of any which has heretofore been adopted in any country."

WE ARE INFORMED that the gross output of the Goldfield Consolidated mine in March was worth $1,074,000, of which $950,000 was profit. We congratulate the management.

IT IS INTERESTING to note that James J. Hill, a Canadian, working mainly in the interest of vast American enterprises which his genius has created, now controls the greatest developed Canadian coalfield through his dominance of the Crows Nest Pass Company. The old board of directors has just resigned and a group that stands for Mr. Hill succeeds to the management. The merely national point of view is absent from a man with such relationships, but the Canadians are evidently in doubt where to class his sympathies. After all, trade is catholic; it has no political prejudices; it is even averred in many quarters that its patriotism is expressed solely toward peace and prosperity.

EXTRAORDINARY developments are being made in the copper mines at Ely, Nevada. The force of abundant capital is awakening the Giroux, which had pursued a halting career for years. Preparations for steam-shovel mining are under way, as well as better shaft-equipment for extracting the high-grade smelting ores from the Alpha mine. Additional prospecting with the churn-drill has revealed a remarkable body of sulphide ore on the Cumberland-Ely, with only 30 feet of overburden. It is thus available at trifling cost by the steam-shovel. This mass of smelting ore is said to be 200 feet thick. Ely is becoming a mightier factor in the copper industry with each passing day. The Steptoe smelter will soon have three mammoth reverberatories in operation, producing 4,000,000 pounds of copper per month.

FROM the report of the proceedings in the House of Assembly of the Nova Scotian legislature, we note that Mr. Wilcox and Mr. Murray gave information concerning the gold mining industry of the Province. In 1908 the average number of men employed in that industry declined to 89, as compared to 292 in 1905. Last year the production of gold was the smallest for any twelve months since 1881. Mr. Wilcox informed his hearers that he could give no reason for this decline; he plaintively mentioned the fact that at the Toronto Exhibition the exhibit from Nova Scotia took a gold medal and a first prize—as if there were any relation between an exhibit of specimens and a prosperous industry. Paraphrasing a local authority, Mr. Wilcox stated that "gold was not a surface metal, but we must follow it to the depths to develop it with any degree of success"—a dictum worthy of a sophomore at a mining school. Then Mr. Wilcox quoted Mr. Faribault, an excellent surveyor and a keen observer, but a sanguine prophet whose vaticinations have not been warranted by the facts in the case. No amount of scientific disquisition explaining why the saddle formations of Nova Scotia ought to be as rich as those of Bendigo will offset the fact that they are not as rich; it is the old story of geological vision and mining realization. Mining is an industry, not a doctrine; it is based on facts, not on theories. It is sheer waste of time to make comparisons between regions half the world apart. After Mr. Wilcox came the Premier, Mr. Murray, a gentleman who has done his best to stimulate the gold mining of Nova Scotia and has done everything except one thing that would have been better than all the other things that he has done, namely, publish the report prepared for the Government in 1905 by a mining geologist specially engaged for that purpose. Mr. Murray made a long speech, and took nearly as long to offer excuses for the failure to publish that report as if he had read the report itself. According to the Premier, the very plain advice given in that report was unpalatable to those who desired to give a fillip to gold mining in Nova Scotia. It is slightly more than three years since Mr. Murray received the report, and it is apparent that the discouraging tenor of it has been painfully justified. The gentlemen at Halifax have behaved like children.

Alaskan Coal Lands.

Social development in its commercial aspects is tending toward monopoly; this may mean consolidation in the interests of individual aggrandizement or of communistic distribution of benefits, according as it be controlled and administered. In some cases statutes and regulations devised to prevent combinations in restraint of trade may prove in effect to be themselves in restraint of trade. We refer particularly to the law of May 28, 1908, for prohibiting coal-monopoly in Alaska. The matter has been brought to the front through the recent order of Secretary Ballinger, directing land agents of the Department of the Interior in Alaska to make speedy investigation of applications for patents to coal lands located prior to the Act of Congress mentioned, where no fraud is discovered. That there was an effort to secure some tracts of coal lands of workable dimensions in Alaska is well known, but we understand that no such wholesale segregation was contemplated as came near placing the entire Great West at the mercy of the railroads. The law of 1908 limits the area which may be consolidated in Alaska to 2560 acres. To those familiar with coal mining on an economical scale this will appeal as being an inadequate size to admit of undertaking operations on such a basis as to permit of cheap production. The installation must be governed by the prospective life of the enterprise. Even in the crowded districts of Pennsylvania and West Virginia, a mine based upon less than 5000 acres would be looked upon as being handicapped by its relatively short future. This would apply with greater force in a region as remote as Alaska. It has been proposed by the American Mining Congress that the law be amended to grant a consolidation of 5120 acres, which seems reasonable. The Act is a drastic inhibition of consolidation by any pretext or subterfuge. That is right. The resources of the people must be controlled, but the permission to utilize them should be upon terms that encourage development along eco-

nomical lines. It is not conservation of resources to limit exploitation so that waste of the substance is transferred to waste in the cost of producing it.

What's in a Name?

A man is entitled to spell his name as he pleases; owing to the early adoption of reformed spelling by people who were careless, many names of similar origin are spelled differently; further, by reason of the multiplicity of persons bearing the same name, individuals have differentiated themselves by changing the spelling of the family name. As a result there is no rule for spelling names, and some of them look like typographical errors. For instance, Stanly A. Easton, the manager of the Bunker Hill & Sullivan mine, omits the e in Stanley, so that he has frequently thrown discredit on our proof-reader. The James family is numerous and energetic; they are alike in being progressive Cornishmen, but they spell their names differently. There is Alfred James, the cyanide specialist; there is the mining engineer, Trewartha-James, who hyphenates the maternal to the paternal cognomen; there is Cordner-James, another able mining engineer; and there is Samuel James, the stockbroker. These four are brothers and the first three of them are in partnership as James Brothers; obviously it ought to be James Brothers & Hyphens. Curtis is not always Curtis; there is J. S. Curtis, the writer of the Survey monograph on Eureka and the prophet of deep-levels on the Rand, but there is also W. B. Courtis. They are not related, but they went to the same school; one of them was designated as "agricultural Curtis" because he had a hoe in his name. We beg pardon, but this is none of ours. In New York there are two well known engineers named Corning; they are second cousins, but the more academic of the two denies close kinship with the other, and yet Christopher Corning and Frederick K. Corning have both done good work as mining engineers, so that it is evident that the family is of good stock. There are many Douglases and yet there is one Douglas. James Douglas is the father of Walter, now the general manager of the Copper Queen, but he is not related to Theodore Douglas; the last has managed to gain an honorable individuality despite the precedence in copper mining of his celebrated namesake of the Copper Queen. Theodore Dwight is cousin to Arthur S. Dwight; both are nephews of R. W. Raymond. The Secretary of the Institute is not related to Robert M. Raymond of El Oro, although they have the same New England origin. The manager of the El Oro mine was born in New Brunswick, being descended from a loyalist who crossed into Canada at the time of the Revolution; his descendant has restored the balance of citizenship. There are as many Moores in mining as there were in the Alhambra. Charles J. Moore made a name at Leadville and Cripple Creek, but he is not related to George Moore of filter fame. There are two Philip Moores, one of them is the Harvard graduate now in charge of the Mic Mac mines in Nova Scotia, the other is Philip N. Moore, of St. Louis, who has done notable work in dredging for gold in Montana. There are enough Turners to form a turnverein. H. W. Turner was formerly with the Geological Survey and is a mining geologist; R. Chester Turner was mine manager at Bodie and then at Tonopah; Scott Turner is a Michigan man and was lately on the staff of the MINING AND SCIENTIFIC PRESS. The Munroes are not all spelled alike. Henry Smith Munroe is professor of mining at Columbia, Charles E. Munroe is professor in the Columbian University at Washington, C. H. Munro is a hydraulic mining engineer, now at Nome; H. S. Munroe is a younger man, recently in South America. The Macdonalds are a troublesome lot in an orthographic way, for there are several ways of spelling that Highland name. Bernard, Joseph, M. E., and Parish J. MacDonald are brothers, in order of seniority. M. E. MacDonald has the honor of being an engineer both fore and aft. Richards is a good old fashioned name and is borne by several useful men. Robert W. of the Massachusetts Institute of Technology is classified with 'Ore Dressing'; J. W. Richards of Lehigh is the authority on metallurgical calculations; H. DeC. Richards, of California, has not written any books, but he could. There are many engineers in the Collins family, and they have all 'made good'. The veteran mining authority, J. H. Collins, now in Cornwall, is the father of Henry F. Collins in Spain, of George E. Collins at Denver, and of Edgar A. Collins at Tonopah. Another brother is Bishop of Gibraltar. The brilliant mining engineer Arthur L. Collins, assassinated at Telluride, was one of this family, all of whom have proved the value of inherited instincts, for they are Cornishmen. Walter McDermott, one of the leaders of the profession in London, must not be confounded with C. McDermid, the efficient secretary of the Institution of Mining and Metallurgy. Thomas H. Leggett, now residing at New York, is not related to J. H. Leggett, who also dredges for gold at Oroville. There is also Alexander Leggat, of Butte. The Peirces, Pearces, and Pearses have their own ways of spelling and pronouncing their names: Richard Pearce, the pioneer copper metallurgist, spells his name in the good old-fashioned way; his sons are Harold V. Pearce and Arthur W. Pearce. George W. Peirce, now at Goldfield, pronounces his name like Purse, so might Arthur L. Pearse, that most nomadic of men, but he makes it correspond with Pierce. Then there is S. H. Pearce, of Johannesburg, who has differentiated himself from the miners by his skill as a cyanider. R. J. Frecheville is the elder brother of William. Herbert C. Hoover is the elder brother of Theodore J.; they are sometimes confused with Edward Hooper, because of a former joint connection with Bewick, Moreing & Co. P. R. Bradley is the younger brother of Fred W. E. D. Ingall is not more singular than Walter R. Ingalls, the editor. S. F. Emmons, the geologist, is not related in any way to Stephen H. Emmens, the alchemist. William H. Emmons of the Survey is the nephew of S. F. John A. Church of New York is not related to L. C. Church, of Joplin, but he has a son named John A. Church, Jr., who is now at Guanajuato. The Farishes constitute a notable group. William A. Farish is the elder brother of John B.; both of them have sons in the

profession. George E. Farish, at Mexico City, is the son of John B., while W. A. Farish, Jr., of El Paso, perpetuates his father's name. Fred G. Farish, who is associated with John B., is not a relative, although distantly connected. L. S. Austin, the professor of metallurgy at Houghton, spells his name differently from Peter T. Austen, the chemist, of New York, but he is the brother of T. S. Austin who died recently at El Paso, and he is the father of Arthur W. Austin, now at work in the Anaconda smelter. W. Rowland Cox, of Spurr & Cox, is the son of William J. Cox, manager of the Camp Bird mine, but he is not related to S. Herbert Cox, the professor of mining in London, nor to Thomas Cox, who was at Ely and is now at Cerro de Pasco. And shall we venture to disentangle the Smiths? We confess to a great respect for a Smith who manages to get out from among the "and others" of his family and achieve distinction. It is easy for a De Kalb or a Weatherbe to win individuality, for there are none of the same name, and the other fellow would be eclipsed anyhow, but a Smith has to get out of the ruck before he begins to see daylight. They spell their names variously, but most of them must be pronounced good. We have H. L. Smyth of Harvard, an honor to any family; we have Howard D. Smith of San Francisco, and Frank Clemes Smith, formerly of South Dakota and now at Bisbee, where Franklin W. also resides; we have J. Audley in Queensland and Percy Bosworth in India. Pascal said that a man was a reed, but he was a thinking reed. That describes several of our friends. They spell themselves variously. Thomas T. Read was formerly at Colorado Springs and is now professor of mining in the Imperial University of Tientsin. John A. Reid, a young Californian, has won his spurs as a mining geologist. He spells his name like H. Fielding Reid, of Johns Hopkins University. H. W. Reed, the manager of the Virginius mine, has had much to do with the development of southwestern Colorado. David C. Reed is at Cerro de Pasco. It used to take nine tailors to make a man, but nowadays one Taylor more than suffices to make a mine. John Taylor & Sons, a firm that is the dean of the mining profession, is represented in London by Robert, Frank, Edgar, Henry, and Arthur of that name. F. M. Taylor, of Taylor & Brunton, is known as an ore sampler *par excellence*; Lewis H. Taylor, Jr., of Philadelphia is a mine operator in Mexico and elsewhere. Frederick Anton Eilers, the pioneer of lead smelting, is the father of Karl Eilers of the American Smelting & Refining Co. Henry, Walter B., and Horace Devereux are brothers. W. B.'s sons (William G. and W. B., Jr.) are in partnership with their father. The Rickards are a necessary evil in mining: Thomas Rickard, of London, is the head of the family, being the only survivor of five brothers; his sons are T. A. and Forbes; his brother Reuben left two sons in California, one being Thomas, who is in the machinery business, and the other Edgar. Harold is the son of Alfred Rickard, the youngest brother of the senior Thomas. Pierre de P. Ricketts and L. D. Ricketts are occasionally confused, the doctorate bestowed on both tending to increase the confusion by eliminating a possible difference. They are not related, but there is a family connection, both being descended from a former governor of Bermuda, who was named Rickard and had his name mis-spelled in the document appointing him. The Nichols and their sons are worthy of record. There is Frank Nichols, recently editor for the Canadian Geological Survey; Asken M. Nicholas, the inventor of filter-presses, now in Australia; Horace G. Nichols, also an expert cyanider and filterer; J. Clayton Nichols, a mining geologist in Colorado; and Ralph Nichols, who is the best known of this clan, formerly manager of the Boulder Perseverance mine, then in charge of the Avino mines, Mexico. William H. Nichols, of the chemical company of that name, is a household word in the metal business of New York. Frank and Hudson H. Nicholson are not related. E. M. and A. B. Rogers are the two sons of A. N. Rogers, a notable figure in the mining history of Gilpin county, Colorado. Both are connected with the North Star mine, in Arizona. Allen H. Rogers is a Boston engineer, now in Chile. The Janins once formed a notable group: Henry has retired and lives in London, Alexis died in 1897, but Louis is still in harness. His son Charles is the partner of Howard Smith. Ross E. Browne is brother-in-law of Charles Hoffman, who is the father of four capable mining engineers: George, Ross, Karl, and John. Louis Metzger married F. W. Bradley's sister and Robert Kinzie is married to the sister of his assistant, E. P. Kennedy. John Hays Hammond, the mining financier of New York, is not related to I. B. Hammond, the machinery manufacturer of Portland, nor to John H. Hammond of Denver. In San Francisco John Hays Hammond and Wendell P. Hammon are occasionally confused by reason of their common interest in gold dredging. J. Nelson Nevius often has his name spelled like the Nevins family. William H. Shockley is cousin of J. H. Shockley; they are sometimes confused. Arnold Hague is the brother of James D. Hague, and Arnold Becker is the nephew of George F. Becker. Horace V. Winchell is the brother of Alexander N., now professor of geology in the University of Wisconsin. Alexander Winchell is an uncle of these men; U. S. Grant is brother-in-law to Horace V. Winchell. Alpheus Williams, the manager of De Beers, is the son of Gardner F., who first systematically developed the Kimberley deposits. Arthur R. Thomas is the son of the late Capt. Josiah. Charles S. Thomas, Jr., is the son of Charles S. Thomas, the celebrated mining lawyer of Denver. Chester A. Thomas is the resident manager for the Yukon Gold Company, and F. F. Thomas is the man who opened up the Gwin mine. Francis A. Thomson, professor in the University of Washington, W. R. Thompson of the Orford Copper Works, and W. B. Thompson, of Wall Street, should be easily distinguished. By the diversity of their pursuits they illustrate the fact that mining needs many talents.

What's in a name? It is the one thing that belongs peculiarly to the individual, differentiating him from all other men. Therefore the least courtesy any of us can do is to spell and pronounce another man's name as he chooses to spell and pronounce it. In this matter he is the sole arbiter.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

HENRY KRUMB is at Globe, Arizona.

BERNARD HILL has gone to British Guiana.

RALPH NICHOLS was at New York recently.

A. CHESTER BEATTY is at San Antonio, Texas.

W. J. SHARWOOD is here from the Homestake.

A. H. WETHEY has returned to Butte from Europe.

W. SPENCER HUTCHINSON, of Boston, is in Jamaica.

EDWARD T. BAILEY is on his way to the East Indies.

R. GILMAN BROWN is on his way to Mukden, Manchuria.

W. F. A. THOMAE has returned to London from Colombia.

J. R. FINLAY is examining mines in Siskiyou county, California.

C. A. THOMAS, manager for the Yukon Gold Co., is on his way to Dawson.

JAMES EARLS is superintendent of the Gold Hunter mine at Mullan, Idaho.

J. POWER HUTCHINS is at Mountain Ranch, Calaveras county, California.

ARTHUR W. STEVENS was in San Francisco, and has returned to Boise, Idaho.

FRANK M. ESTES, Jr., is with the El Oro Mining & Railway Co., at El Oro, Mexico.

CHESTER W. PURINGTON will be in San Francisco on April 10, on his way to Siberia.

F. H. MORLEY, of Denver, is now associated with DOMINIAN & SMITH, of Mexico City.

CLAUDE T. RICE has left New York to take a position at the Marmato mine in Colombia.

EDMUND JUESSEN, of Spokane, will be manager of the Silver Peak mine, in Nevada, on May 1.

CARLOS W. VAN LAW has resigned as general manager for the Guanajuato Reduction & Mines Company.

A. C. LAWSON has been chosen one of the associate editors of *Economic Geology*, in the place of H. Foster Bain, who resigned.

E. H. BENJAMIN has been elected vice-president of the Joshua Hendy Iron Works, succeeding the late RAOUL CHARTREY.

Obituary.

WALDEMAR ARENS, general manager for the Iron Silver Mining Co., at Leadville, Colorado, died at his home in California gulch, Leadville, on March 23. He succumbed to pneumonia, at the age of 79. A native of Germany, he came to America when a child, and reached Leadville in 1878, so that he was a pioneer in that great mining district, becoming associated with Levi Z. Leiter and William Stevens. He was highly esteemed; his word was as good as his bond; he was an honorable man.

A. P. KENNEDY, manager for the Hillabee Gold Mining Co., in Tallapoosa county, Alabama, was killed by an accident on March 16. While superintending repairs on a power dam, he was crossing in a boat from one side of the pond to the other, and going too near the brink he was carried over backward, being killed instantly by the fall. Born at Camden, Indiana, he was 40 years of age; he was educated at Purdue University, graduating in 1895. In 1897 he went to the Alabama goldfield, and proved himself a most capable engineer.

Dividends.

On April 3 the Bunker Hill & Sullivan Mining & Concentrating Co. pays dividend No. 139, of $45,000. This makes the amount of dividends paid since January 1, $255,000, and the total to date $10,926,000.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, April 1.

Antimony	12@12½c	Quicksilver (flask)	44@45
Electrolytic Copper	15¼@15½c	Spelter	6¼@7c
Pig Lead	4.35@5.30c	Tin	32@33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 25. £. s. d.	Apr. 1. £. s. d.
Camp Bird	0 16 0	0 16 3
El Oro	1 4 0	1 5 0
Esperanza	2 16 3	3 0 0
Dolores	1 10 0	1 10 0
Oroville Dredging	0 10 3	0 10 3
Mexico Mines	4 16 3	4 8 0
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 26	12.37	3.98	4.76	50⅜
" 27	12.37	3.98	4.76	50⅜
" 28	Sunday.	No market		
" 29	12 37	3.98	4.76	50⅜
" 30	12 50	4.10	4.76	50½
" 31	12.56	4.10	4.76	50⅝
Apr. 1	12.56	4.10	4.76	50½

MINING QUOTATIONS—NEW YORK.

	Closing Prices. Mar. 25.	Apr. 1.
Amalgamated Copper	70⅜	76½
American Smelting & Refining Co	87	88⅜
Boston Copper	10½	11½
Butte Coalition	23¾	24⅝
Cumberland-Ely	7¾	7¾
Dolores	6¼	6½
El Rayo	2⅝	2⅝
Giroux	8	8¼
Greene-Cananea	9	10⅛
Indiana Sonora	3¾	3¾
La Rose	6⅜	6⅞
Miami Copper	13⅜	14½
Nevada Consolidated	18½	20
Newhouse	3⅞	3½
Nipissing	10¾	10⅝
Ohio Copper	6½	6⅝
Tennessee Copper	41⅛	41⅜
Utah Copper	42¾	43½
Yukon	4⅛	4¼

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. April 1.		Closing Prices. April 1.
Adventure	8½	Mass	6⅛
Ahmeek	150	Mohawk	62½
Allouez	39½	North Butte	72⅛
Arcadian	4⅞	Old Dominion	51¼
Atlantic	13¼	Osceola	130
Calumet & Arizona	101	Parrot	34
Calumet & Hecla	620	Santa Fe	2⅛
Centennial	30½	Shannon	14
Copper Range	77	Superior & Pittsburg	14
Daly-West	10½	Tamarack	76
First National	6¼	Trinity	14⅜
Franklin	15½	United Copper Con	12⅝
Granby	97	Utah Con	41¾
Greene-Cananea, ctf	10	Victoria	4⅜
Isle Royale	26⅛	Winona	5½
La Salle	14¾	Wolverine	144

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, April 1.

Atlanta	$ 13	Midway	$ 22
Belmont	94	Montana Tonopah	71
Booth	19	Nevada Hills	1.25
Columbia Mtn	13	Ophir (Comstock)	1.05
Combination Fraction	1.15	Pittsburg Silver Peak	67
Daisy	47	Rawhide Coalition	66
Fairview Eagle	15	Rawhide Queen	45
Florence	3.15	Round Mountain	77
Goldfield Con ...(ex div. 30c)	7.75	Sandstorm	13
Gold Kewenas	15	Silver Pick	14
Great Bend	17	St. Ives	13
Jim Butler	18	Tonopah Extension	60
Jumbo Extension	20	Tonopah of Nevada..(xd 35c)	7.75
MacNamara	31	Tramp Con	4
Mayflower	14	West End	32

General Mining News.

ARIZONA.

PINAL COUNTY.

S. L. Gibson and William Henderson have effected the sale of the mines of the Gibson Copper Co. to a syndicate in Boston for about $650,000. The mine has been remarkable for producing sulphide ore from grass roots down to the 400-ft. level when signs of exhaustion were indicated. A short time ago, however, a winze struck another body of high-grade copper ore, and soon after, the deal in Boston was consummated.——From Steamboat Rock, to the east of Kelvin, come reports of the discovery of gold ore by J. H. Bates and A. Sears. These two men were grubstaked by S. D. Gardom and Phil Grigsby, of Phoenix.

YAVAPAI COUNTY.

A rich strike of copper sulphide is reported from the Grand Island Copper Co.'s property, five miles south of Jerome. The shaft is 84 ft. deep, and has cut a vein 3 ft. wide.——Diamond drilling has been started at the Sycamore mine on the Verde river near Sycamore creek.

YUMA COUNTY.

John S. Reilly and J. W. Milnes have returned from a visit to the new gold camps near Salome, in the Granite Wash range, and state unconditionally that it is the richest ever made in Arizona. The gold occurs native, commonly in wire form, and is found in a slate schist formation intersected by diorite dikes. The original strike was made by



Parker, Arizona.

Al Alger, Henry Barker, and Herman Griffin, on one of the claims of the Arizona Northern group, but finds are made over a wide area of the schist belt. Although phenomenally rich finds have certainly been made, it must be distinctly remembered that up to the present there is not so much as a 10-ft. hole in the entire region of the discovery.

The Yuma Copper Co. has been organized in Houghton, with Samuel Brady, superintendent of the Michigan mine, as president. John L. Harris, of the Hancock mine, is vice-president, and C. C. Douglas secretary. The capitalization is $200,000 and is organized under Arizona laws. The property consists of upward of 600 acres of copper lands on the Arizona & California railroad cut-off.

CALIFORNIA.

FRESNO COUNTY.

Talk of a possible railroad into the Minarets region is being renewed as a result of the investigation made by Paul F. Mohr. He found tungsten, iron, and copper ores, while both silver and lead had previously been found by J. W. Drouilliard and others. From a scenic point of view the road would be one of the finest in the State.

INYO COUNTY.

(Special Correspondence).—The Treasure Hill Co. is rapidly perfecting arrangements for unwatering and operating the old Tower property. Men are being engaged, and new machinery will soon be installed. W. Gillette Scott is manager.——The 100-ton cyanide plant at the Keane Wonder mine has been placed in commission. It is expected to add from $5000 to $8000 per month to the present output, which is now approximately $20,000 per month.——At the North Inyo Consolidated property the lower tunnel is being pushed ahead steadily. Several veins of low-grade ore have been encountered. M. T. Stovall is manager.——The Tecopa mines are maintaining large outputs of silver and lead. It is rumored that this company has secured a controlling interest in the Needles smelter, and within a short time will largely augment its working force. The Cerro Gordo mine is maintaining steady shipments of good ore to the Keeler smelter. During the present summer the capacity of the plant will be materially enlarged.——Work continues at the Greenwater Death Valley mine with fairly satisfactory results. The big vein of copper-bearing ore opened on the 1000-ft. level is being developed. The shaft is being sunk to 1500 ft.——Considerable prospecting is being done in Gold valley.

Bishop, March 27.

The Furnace Creek Copper Co., which has been operating in the Greenwater district for the past two and a half years, has finally given up hope, and work has been entirely suspended. James Casey, the last of the employees, will shortly leave the camp.

Clarence A. Beall has taken charge of the Casa Diablo mine and mill. The mill has been re-started, and there is enough ore on hand for more than a month's run.

NEVADA COUNTY.

(Special Correspondence).—A small force of men are working at the old Washington mine, a short distance above the Idaho-Maryland. This is the first time the Washington has been worked for a long term of years.——Operations have been suspended on the Midas and an assessment levied to defray further expenses.——The Black Bear Co. is pushing work on the Forlorn Hope claim. A deal has been closed for several adjoining properties, and a 10-stamp mill has been purchased.——It is reported that a San Francisco company is being formed to operate the Rose Hill mine. The property has been idle for several months, but some work is now being performed by a small crew.——The Dana Co. is arranging for the installation of a hoisting and pumping plant, and later on will erect a stamp-mill. A 7-ft. vein of fair-grade ore is being developed. John Burgess is superintendent. Tonopah people are principally interested.——A lower tunnel is being driven at the Kentucky Ridge mine and is in about 75 ft. It is expected to intersect the lode at considerable depth below the old workings. ——Considerable leasing is going on in the Grass Valley and Nevada City districts. Mines that have lain idle for years are being re-opened and worked. This state of affairs is due to the large number of idle men in this section. Many of the lessees are meeting with encouraging success.

Grass Valley, March 29.

Ten additional stamps are being dropped in the Champion mill, making 30 in all. There are also 20 dropping at the Home, on the opposite side of the creek. The ore that is being crushed is being taken out by tributers, of whom there are 54 in the mine. This, with the 26 men on the payroll, makes 80 at work in the Champion properties.——The region around Graniteville is becoming more active. At the Birchville mine a 10-stamp mill is running on ore extracted last year, and a pump has been started to unwater the shaft. Both on the El Oro and the Keller properties development work is being done.

SAN BERNARDINO COUNTY.

Shaft work is being completed at the Oro Belle mine, and the new hoist is doing excellently. In a few days the station on the 100-ft. level will be ready, when cross-cutting and driving will be started. The end-lines of the Oro Belle are contiguous to the property of the Hart Consolidated Co.——Ivanpah is an old silver-producing camp about 24 miles west of Hart, abandoned in the days when silver depreciated in value. The work being done on the Clansman group, lying at the extreme southern end of the camp, is exciting favorable attention. There is a surface showing of 2 ft. of ore, running about 80 oz. silver and development

to the depth of 30 ft. has uncovered a 3-ft. vein of excellent grade. Kewanee, a new gold camp, lies about a mile to the south of the Clansman.

SHASTA COUNTY.

The Noble Electric Steel Co.'s smelter is to start work this week at Heroult. Delays in getting to work have occurred so often that it is hoped that this announcement may at last be true.——It is stated that the Mountain Copper Co. contemplates the development of its Hornet claims near Keswick, which are said to contain more than 5,000,000 tons of ore which will average about 1¾% copper. The management is planning the development of this big deposit by the caving system, and will probably build a new plant to treat this low-grade ore.——The report that the First National Copper Co. is restricting operations is declared by Thomas J. Barbour, the vice-president, to be untrue. It is shipping 600 tons of ore per day to its smelter, or sufficient to maintain its mine and smelter organization of 500 men. However, he says that there is no intention of producing more than 1,000,000 lb. monthly under present conditions of the copper market.——Austin Brown, formerly general manager of the Trinity, has recently made an examination of the properties, accumulating data for a comprehensive report on the present status of the mine. Meanwhile the Trinity property remains shut down and nothing is being done there.

TUOLUMNE COUNTY.

It is authoritatively asserted that operations will shortly be resumed at the property of the United Mines Corporation. It is situated east of Tuolumne, and consists of the Dead Horse, Eureka, Grizzly, New Albany, Lady Washington, and other claims. Work ceased at the property a month ago as the result of a dispute. S. A. James of Cleveland has become general manager and will arrive here this week to pay off all indebtedness. J. M. Elmer will continue as superintendent.——The Duffield and Sonora mines, situated near Arastraville, have been bonded to Stephen Lavagnino, and a crew has been put to work. The price to be paid for the property is $10,200, of which $500 has been advanced. ——A 10-stamp mill has been purchased for the Kavanaugh-Mangante mine, near Jamestown.

TRINITY COUNTY.

It is reported from Trinity Center that the Headlight mine near Carrville has been sold. The mine was once equipped with a cyanide plant, but was burned three or four years ago.——The electrical power-plant at the Bonanza mine, a former Treadwell property, near Trinity Center, has been destroyed by fire.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—E. J. Wilcox, of Denver, general manager of the Waldorf Consolidated M. & M. Co., states that the 125-ton mill near the portal of the Wilcox adit will be doubled in capacity. It is hoped to have the mill ready inside of 90 days. Driving will be started upon the Paymaster, Commonwealth, and Central Indiana veins, while the main bore is to be advanced about 900 ft. to intersect the ninth level of the Stevens mine.——Since the Argentine Central road was constructed, about four years ago, it has never been operated on Sunday. A change will take place this year, however, as a contract has been entered into with the Colorado & Southern whereby the line will be kept open during the entire year. This has been necessitated by the great amount of ore that is being mined in the Argentine district.——A contract has been entered into by the Argentine-Montezuma M. T. & T. Co. for electric power to be furnished by the United Hydro P. & E. Co., of Georgetown, and within 60 days it is believed that the change will be accomplished. It is estimated that a saving of from $800 to $1000 per month may be effected.——The Domino M. & M. Co. is employing men to advance the adit No. 2. A vein was passed a few days ago which shows strong mineralization. Driving is to be started for proving the ground. H. Cochran is manager. ——A. A. Hayden, of Denver, secretary of the Golden Glory M. Co., has arrived in camp from Texas. Funds have been provided, and the Golden Glory adit will be continued into Saxon Mtn., while other men will develop the Drummond group of five claims, situated on Columbia Mtn. J. L. Young has been appointed resident manager.——The rough-jigging plant at the Bellevue-Hudson mine has been brought into use again after a temporary close-down of a few weeks, due to lack of water. An average of five tons are being treated each hour.——The Boston vein, owned by the Philadelphia Mining Co., is developing into a good producer. A stope is showing from 16 to 20 in. of solid ore worth $25 per ton in silver and lead. A big body of mill dirt is being trammed to the Dover mill for concentration. J. W. Boyd, of Idaho Springs, is manager.——The Standard Ore Co. has been incorporated by W. F. Collins and E. Leet, of Idaho Springs, and J. M. Grace, of Denver, with a capitalization of $250,000. The corporation has secured control of a block of ground at the Shafter mine, Bellevue Mtn., and work has already been put under way.

Georgetown, March 28.

IDAHO.

BLAINE COUNTY.

The Croesus mill is working well, but the grinding capacity has been found inadequate, and is being increased. Other changes will be made so that in a few weeks the mill will work up to its daily capacity of 80 to 100 tons.

IDAHO COUNTY.

The property of the Idlewilde Mining Co. near Elk City is being developed. The adit to tap the orebody at a depth of 250 ft. has advanced 310 ft. The surface of the vein has been thoroughly explored, and at a depth of 30 ft. an 8-ft. vein was found carrying $25 free-milling ore. The cost to mine the ore is estimated at $7 per ton. If the adit cuts a good orebody a 10-stamp mill will be erected. George Sheil is president, and J. W. McCune secretary.

P. J. Jennings, of Portland, intends to dredge the Gold Seal placer ground, an area of about 400 acres at the confluence of Elk creek and the American river, or about a mile from Elk City. The machine is reported to have been ordered in Milwaukee.

SHOSHONE COUNTY.

(Special Correspondence).—A deal has just been completed by which the controlling interest in the North Fork Consolidated Mining Co. has been bonded to Eastern capitalists for $250,000. The bond goes into effect May 1. The claims adjoin the Snowstorm mine at Mullan and have been extensively developed. A good showing of ore has been made.——More than 7 ft. of fine chalcopyrite is showing in the face of the drift being run from the foot of the shaft in the Horst Powell mine, on the Little North Fork. Over $8000 have been spent on development work in the last six months. It is expected that regular shipments will be commenced as soon as the extension of the Idaho Northern railroad is completed into that part of the country.—— A report of the Acme Consolidated Silver-Lead Co. shows that the present drift is now in about 540 ft., and that bunches of iron carbonate, silver chloride, and lead carbonate have been exposed. The quartzite is said to be thoroughly impregnated with lead, while two feet of blue quartz speckled with iron sulphide and galena shows in the face. ——The Star Mining Co. at Mullan has been running a drift along an 18-in. vein of clean shipping ore and a large quantity of milling ore has also been exposed. The ore is the highest grade that has ever been encountered in the mine. It was reported earlier in the season that this mine had been sold to the Federal Mining & Smelting Co., and that it was to be worked through the Morning mine at Mullan, but the truth of this report has never been confirmed.——The 640-ft. 3-compartment raise from the No. 4 to the No. 3 level of the Hercules mine at Burke has been completed. The raise took seven months to complete, and opens a large amount of new stoping ground.——The long tunnel at the Snowstorm mine has again caved in at the same place as before, and the management has determined to drive around the cave to avoid this bad part of the ground. The cave-in affects about 50 ft. The shipments

from the mine have been reduced from 500 to 200 tons per day.——The well-known dispute involving the ownership of the Neversweat lode mining claim at Burke has at last been finally settled, and John Mader's application for title will now be granted. A consignment of new machinery, including a new hoist, has been ordered for the claim, and development will forthwith be continued.——A report issued by the Idora Mining Co. states that 50 ft. of a raise from No. 3 level has so far been completed, and is in clean shipping ore all the way. The raise will be 380 ft. in height to reach the No. 2 level. Additional machinery and concentrators are to be installed this spring.——The Hypotheek mine in the Kingston district has closed down owing to a break in machinery. The shaft is at present 450 ft. deep. An assessment of 5 mills per share is now delinquent.——Charles A. Solberg and H. P. Ward have resigned from the positions of president and secretary, respectively, of the Amador Copper & Gold Mining Co., and their places have been filled by A. T. Ryan and George F. Stoney of this city. At a recent sale of stock for delinquent assessment the company bought in 650,000 shares, and the directors are considering if those who lost their stock may have the opportunity to redeem.

Wallace, March 27.

An inrush of water has stopped work in the shaft of the Caledonia mine. An electric pump of 75 gal. a minute against a 500-ft. head will be installed, and sinking will then be resumed. Meanwhile driving on the vein is being continued and the silver-lead ore is being stored at the rate of about 50 sacks a day. The company has on hand several carloads of ore for shipment, which are being held awaiting better market conditions.——The miners of the Government Gulch Mining Co.'s property have broken into solid galena ore in the drift run from the 100-ft. level of the shaft. The claims of the company adjoin the Federal and the Stewart mines.

MICHIGAN.

The Isle Royale Copper Co. crushed 218,940 tons of 'rock' in the year, yielding 13.8 lb. copper per ton, or a decrease of 1.4 lb. The mine has been worked principally to improve development, as is shown by the large expense item of $309,500 for construction. The cost of the copper per pound at the mine was 16.91c., which is further brought up to 28.99c. when construction and smelting are included.——Adventure has temporarily ceased diamond-drill operations owing to an accident to the diamond-drill outfit. The machine was engaged in sinking a hole to further test the lodes discovered during the past year, and had reached a depth of 1600 ft.——Seneca is engaged in drifting on the 200-ft. level in an endeavor to find the main body of the Kearsarge lode.——James MacNaughton, general manager of Calumet & Hecla, left yesterday for Old Point Comfort to recuperate from his recent illness. Most of his work will devolve upon William Uren, who will continue as assistant to the general manager.

MONTANA.

LEWIS AND CLARK COUNTY.

Confirmation of an important strike of copper-bearing ore on the Wolf Creek Mining Co.'s property is made by C. E. Russell, the manager of the property, who says that the orebody cut at a point 200 ft. below the apex of the vein is 4 ft. wide. The face of the main adit, 447 ft. long, is in good ore. Samples of the entire vein assayed $71 per ton based on 12½c. copper, while picked specimens ran more than 40% copper. The company is a Spokane corporation, most of the stock being held in Washington and Montana. T. G. Cooper is president, C. E. Russell is vice-president and manager, and R. E. Vincent is secretary and treasurer.

MISSOULA COUNTY.

Operations at the Monitor copper mine, about 4 miles south of Saltese, have been suspended owing to the heavy snows and lack of fuel. The snow is now over 12 ft. deep. O. H. Linn is superintendent.——The drift on the property of the Golden Eagle Mining Co., on Spring gulch, is in now about 400 ft., and has encountered galena that gave assay returns of $48 per ton.

NEVADA.

ESMERALDA COUNTY.

It is announced that George W. Nixon had sold to George Wingfield his entire holdings in the Goldfield Consolidated Mines Co. Nixon was president of the company and owned 250,000 shares. The stock was taken over at $8 per share.——The Walker Lake Gold Mining & Milling Co. is operating its property about 13 miles from Schurz. An adit 325 ft. long has been run with the intention of blocking out ore to supply a 10-stamp mill. The high-grade ore found up to the present is not in sufficient quantity to justify shipping. Altogether 1800 ft. of development work have been done. E. S. Davis is president of the company.

The Blue Dick vein at Lida belongs to Nick Parish and others. From it they have obtained rich gold, silver, and lead ore, but lack of capital to make the best of it.——The Storm Cloud M. Co. is an extension of the Blue Dick, and has an adit 550 ft. long, from which cross-cuts are now being made.——About 3 miles west of Lida the Indian Spring Copper Co. is installing a steam hoist and pumps, and have let contracts for the supply of fuel.——L. E. Campbell is working and shipping turquoise ore from the claims of the Washington-Nevada Mining Company.

NYE COUNTY.

(Special Correspondence).—The Tonopah Mining Co., at a meeting of the directors on March 25, declared the regular quarterly dividend of 25 cents per share, and an extra dividend of 10 cents payable on April 21. This makes a total to date of $4,500,000 paid in dividends. The Mizpah shaft is now down 1296 ft., and the flow of water has increased to between 60,000 and 70,000 gal. per day. The mill report for the week shows that 3075 tons of ore were crushed.——Dennis Searles, secretary of the West End Mining Co., has announced that a mill is to be built by the company in the near future, in conjunction with the Tonopah Extension. If the West End should not erect a mill at once the Extension will construct a 30-stamp mill modeled on that of the Montana, but with Brown agitators instead of Hendryx.——The State Legislature, just adjourned, passed a law with reference to the filing of reports of mining companies. The main provisions are as follows: That every mining company operating in Nevada shall twice a year file with the County Recorder a statement of these following facts: Name of each claim and total number being worked, with their location; nature of title, and date of acquiring same; value, character, etc., of all buildings, machinery, etc., on each patented and unpatented claim; total number of days labor employed in development of each claim during the six months preceding report; total number of shares authorized by law, and par value of each; shares set aside for treasury stock, and amount realized from sale of such; number of shares of treasury stock held unsold; salaries paid during past six months preceding report. Each June and November a copy of this report shall be mailed to every stockholder of record. The bill was introduced by Senator Kendall of Nye county, and is now a law.

Tonopah, March 29.

WHITE PINE COUNTY.

The Nevada Consolidated shipped during January 1,451,000 lb. of copper; in February 1,035,000, and from March 1 to 20 inclusive, 1,086,000, or at the rate of 1,680,000 lb. per month.——Three reverberatory furnaces are in full blast at the plant of the Steptoe Valley Smelting & Mining Co. The third furnace which was blown in the first of the month, is doing good work, and furnace No. 2, which was shut down for repairs, is again in service after being out of commission only a week. Nine MacDougall roasters are now in use, but construction in progress will bring the total up to 16. The superintendent for the Minneapolis Steel & Machinery Co., has finished his contract for the steel work on the fourth unit of the concentrator. Work of placing the machinery for this unit will be commenced at once.——The general manager of the Giroux Co. has

one Keystone drill at work near the Bunker Hill shaft. Two more drills which were damaged by the fire some months ago at the Giroux smelter are being repaired and two new machines have been ordered.

No satisfactory location has as yet been found for the new shaft, to be called the Giroux, and sunk near the Alpha. It will be 5-compartment, and 18 by 10 ft. inside dimensions. A double-decked cage will handle 35 men at a single trip or will take a mine-car loaded with 9-ft. timbers without shifting the load. Two skip-ways, 4½ by 5 ft., will handle five-ton skips, working in balance. The remainder of the shaft will be used for ladder and pipe-ways.

UTAH.

BOXELDER COUNTY.

The New Eldorado Mining Co., operating in the old Ashbrook district, is advancing to development work to enable shipments to be made this summer. The president, Thomas Sherry, asserts that some of the ore runs 23% lead, 14 oz. silver, and $1.80 in gold.

JUAB COUNTY.

Benjamin H. Bullock has found some shipping grade of copper sulphide ore in the 210-ft. level of his mine. The



Utah.

new vein is 2 ft. thick, and two others have been worked on the same level.——W. M. Owen, superintendent of the Eagle and Blue Belle has received instructions to advance the 1400-ft. level into the King William property. It will require about 280 ft. of work, when a raise will be made from the 1900-ft. level of the King William to the 1400-ft. level.——The Grand Eastern Mining Co. has been incorporated with a capital of $100,000 to work eight claims in the southern part of the Tintic district. The officers of the new company are E. R. Higgenson, president, A. F. Baxter, C. E. Berry, W. E. Sainsbury, and John A. Allen.——Four furnaces are now in operation at the Tintic smelter, a copper furnaces having been blown in last week. It is believed that the starting of this copper furnace will mean a resumption of work at both the Grand Central and Victoria mines, both of which have contracts with the Tintic smelter. ——The shaft at the Centennial Eureka mine is now down to a depth of 2225 ft. and a station will be cut at this point. R. A. Brown and C. E. Allen are considering putting in an electric pump of 1000 gal. per minute at this level, and then continue sinking to 2500 ft. By pumping the water to the surface through the Bullion Beck shaft about 425 ft. of lift can be dispensed with. The Centennial Eureka Co. has been operating to a depth of 2000 ft. for several years, and one of the largest orebodies in the mine is now being worked at that level.——The Yankee Consolidated Mining Co., in Tintic district, ships an average of four cars of ore per month, and there are five sets of lessees each shipping a carload a month from the same mine. This is a lead-silver ore, sampling from 15 to 40% lead, and 10 to 30 oz. silver per ton, with a small amount of gold. It contains also a good percentage of iron and manganese. The main purpose of the company now is thorough development, 4200 ft. of which was accomplished last year. Lewis Merriman is superintendent. The Yankee ore is shipped to the Salida smelter.

SALT LAKE COUNTY.

The annual report of the Utah Consolidated Copper Co. will be issued in a few days. Two dollars were paid in dividends in 1908, as against $7 in 1907, and it is expected that the surplus will not be as large. The company has a contract with the American Smelting & Refining Co. for the smelting of ore, which has about a year more to run. After the contract expires the company will send its product to the new smelter in Pine canyon, which is being built by the Cole-Ryan group. E. P. Mathewson is reported to have said that the smelter will assuredly be ready for work next January, and that the saving in charges thereby effected will be equal to about $1 per share of the stock. On the property of the Utah Consolidated are large deposits of lead ore, which so far have never been worked.

SUMMIT COUNTY.

(Special Correspondence).—The Daly-Judge crude ore shipments amount to 200 tons per month, sampling close to 21.9% lead, 16 oz. silver, $1 gold, 11% zinc, 19% iron, and 12.8% silica. The mill is concentrating 140 to 150 tons per day, reducing 5½ tons to 1, making a concentrate that runs 32% lead, 14.7 oz. silver, 10.9% zinc, 19.7% iron, and 2% silica. Besides this, two middling products are made; one running 27% iron, 10 to 14% lead, 2 to 3% silica; the other carrying 30 to 35% zinc, 4% lead, and 14% iron. The iron middling is sold to the smelters and the zinc middling to the Grasselli Chemical Co., operating dry concentrators in the district. All the Daly-Judge ore, both milling and shipping, is brought from the mine through the tunnel which connects with the main shaft at the 1200-ft. level. The shaft reaches a depth of 1600 ft. and there are important workings as low as 1500 ft., which is 900 ft. higher than the Ontario drain tunnel that effects the complete drainage of these properties. At present a greater tonnage of ore is being taken from below the tunnel level than above it, but most of the exploratory work in progress is above that level. E. W. Durfee, general superintendent, states that the mine and mill force is 140 men. J. T. Kescel is in charge of the mill.——The Silver King Coalition Mines Co., whose operations are superintended by M. J. Daly, is shipping 100 tons of crude ore, and milling 150 per day. The average mining costs at this property for 8 months ending December 31, 1908, was $5.64 per ton, the milling costs for the same period averaging $1.068 per ton of ore treated. There are two classes of ore brought to the mill, a sulphide and a carbonate. In the sulphide the greater value is in the lead content, the silver being secondary, the carbonate has a preponderance of silver, but a fair percentage of lead. The average concentrate samples 45% lead and 45 oz. silver per ton. The sulphide concentrate carries 10% iron, 3 to 4% silica, and a low percentage of zinc—not high enough for the smeltermen to charge a penalty. The mill has a capacity of 450 tons per 24 hr., but is now running only one 10-hr. shift.

Park City, March 27.

TOOELE COUNTY.

The Western Utah Copper Co., operating at Clifton, in the Deep Creek region, is estimated to have 100,000 tons of ore blocked out that will assay 4.9% copper, 3.8 oz. silver, and $1 in gold. It contains about 28% iron and 23% silica. The vein is said to be a contact between lime and porphyry, has a dip of 45°, and is 80 ft. wide at one place. It is opened by adits which give a depth of 150 ft. between the

highest workings and the lowest adit. A winze has been sunk 275 ft. below the bottom level. The camp is in the Ibapah range, 46 miles south of Wendover station on the Western Pacific railroad. Duncan McVichie, H. H. Greene, and associates are the interested parties, with J. E. Bergh as engineer in charge.

WASHINGTON.

FERRY COUNTY.

The New Republic Co. reports having shipped five carloads of ore, and three more are ready, of which one carload will assay about $17, another $43, and the third about $60 per ton. The company has contracted to deliver not more than 1500 tons of ore per month to the Tacoma smelter, for which returns will be made on a sliding scale. For all ore with 3 oz. gold or better, the entire gold content will be allowed. The low-grade ore will be used for converter linings. The last carload shipped to the Granby smelter brought returns of $50 per ton, of which the silver was 3 oz. to 2½ of gold.——The lessees of the Surprise claim, on the Pearl Consolidated group, are shipping ore at the rate of a carload per week.——Neil Cochrane, formerly superintendent of the Mountain Lion mine and now managing the Jumper mine in California, will become identified with the camp in June.

OKANOGAN COUNTY.

An electro-chlorination process is talked of for the sulphantimonate ore of the Ruby mine, at the base of Mt. Chopaca. Monroe Harman, the manager, after having witnessed a 30-hr. test run, has pronounced the saving to be satisfactory, and, with the exception of a few slight defects which may be easily remedied, he thinks the process is suited to the Ruby ore.——An 18-hp. gasoline engine is being installed at the Forty-Ninth Parallel mine, near Oroville. A hoist will also be installed, and the shaft sunk to 100 ft.——Placer mining on the Golden Sands claims, on the Similkameen river, three miles above Oroville, is to be resumed by Milwaukee people. An examination of the property has indicated ground worth over $4 per cubic yard.——Funds are being raised in the East for extensive improvement of the water-power of the Similkameen Falls Power & Development Company.

STEVENS COUNTY.

C. J. Johnson, secretary of the Oriole Mining & Milling Co., operating in the Metaline district, announces that tunneling has proved that the No. 1 vein is a contact deposit. There are now 3½ ft. of solid shipping ore carrying silver, lead, and gold worth from $35 to $100 per ton. Another vein is 8 ft. wide on the surface, and will be tapped at a depth of 300 ft. The company has a contract to transport its ore from the mine to Newport for $5 per ton.——The Liberty Copper Mining Co., operating six miles west of Chewelah, has shipped its first carload of ore to the Northport smelter. The ore is from a blind lode encountered in the main adit, hand samples from which assay between $40 and $50. Two shifts are employed at the mine.——Merryland Mining & Development Co. has been organized in Spokane with a capital of $1,500,000 to develop a group of five claims in the Metaline district. W. C. Halliday, who located the property, is president; C. W. Benedict, O. H. Benedict, William Tyler, and R. E. Leslie are the other officers. Assays from the vein indicate ore payable in silver and lead.——The Gold Dyke Mining & Milling Co. has been organized, with $1,000,000 capital, to operate the Lightning and Condor claims, in the Orient district. The incorporators are T. J. Demorest, of Spokane, Fred Buhrig, of Orient, A. M. Glick and A. B. Willard, of Tekoa.——A large shipment of supplies has been sent to the Zodiac mine, on Sophia Mtn., near Northport, for extensive development work.——The adit on the North Star mine is in 375 ft., and ore has been found which assays $20 in gold and over per ton.——The management of the Easter Sunday mine expects to have its mill completed and running by April 15.——Galena of fine quality has been uncovered in a 12-ft. shaft on the Sunday Morning mine, near Rockcut.

CANADA.

BRITISH COLUMBIA.

The British Columbia Copper Co. has shut down its Mother Lode and Oro Denora mines, and the smelters at Greenwood. J. E. McAllister, the general manager, says they will remain shut down indefinitely until the market conditions improve. It will throw about 400 men out of work.——The Nuba and Early Bird mining companies will jointly install a 20-stamp mill on Moresby Island early in April. The order for the plant has been placed in Germany. The Nuba company owns 54 claims near Gold Harbor. Twenty men have been engaged at development work since last fall. Both properties are traversed by the same vein, which varies in width from 2½ to 8 feet.

MEXICO.

FEDERAL DISTRICT.

The manager of the Esperanza Mining Co., at El Oro, reports a new discovery of gold-bearing veins of high value. Cross-cut No. 21, on the ninth level, north section, passed through two sulphide veins 3½ ft., and 5 ft. 10 in. wide, assaying $17.50 and $21 gold per ton, respectively. Cross-cut No. 24 west is also in good ore, but particulars are not known.

OAXACA.

(Special Correspondence).—L. V. Ulrey, of the Indiana-Oaxaca Mining Co., is visiting Mexico, to make the final payment on the company's property near Teojomulco. The mines are in charge of Guy L. Caulfield, who has made a satisfactory showing for the property. The last shipment of ore to the smelter showed an average of $194 per ton. The company expects to install a mill shortly.——The Natividad mine, famous as the richest mine in this State, is in the throes of internal faction between the directors and stockholders. It is generally understood that the opponents to the present president have secured 56 majority for the final meeting to be held on April 3, when it is very probable that a Mexico City man will be elected in his place. The company is controlled entirely by Mexican capital.——The Ocotes mine, the property of the Teziutlan Copper Mining & Smelting Co., is arranging to install diamond-drills for prospecting the property in depth. The company has been securing water concessions for some months past.——The management of the Santa Sophia mine in the Parian district expects to begin the erection of a mill within six months from date. The company is controlled by Boston capital.——C. W. Hunt, of Boston, has been in the Oaxaca district for some weeks investigating the mica production of the State. He has discovered sufficient good mica to warrant shipping the mica in the rough to the States and has made the first consignment.——The onyx of the Etla quarries is now controlled by Ingel Carpenter, of Mexico City. Recent beds of fine green onyx have been uncovered, which meets a popular demand in the New York market. The name of onyx, however, is a misnomer, as the stone in question is really nothing more than marble and is being so billed for the customs duties into the States.

SONORA.

The annual report of the Greene Consolidated Copper Co. covers 6 months of actual operation under the management of L. D. Ricketts, and shows a net profit of $1,606,300. The cost of mining for the total tonnage was $2.13 per wet ton. For fifteen months, ending October 1, 1907, it was $3.28. The cost of concentrating domestic ore, 3.12 tons into 1, was 94c. per ton, obtaining a recovery of 2.65% copper, 0.92 oz. silver, and 0.0075 oz. gold. A dam is being built to store 2,000,000 tons of tailing, hitherto thrown away.

Col. W. C. Greene is credited with the announcement that a new corporation is being organized to take over all his properties in Mexico. The new syndicate will have $40,000,000 capital and is headed by F. S. Pearson of New York. Other prominent men interested in the corporation are José Limantour, Sir William Van Horn, and E. N. Brown.

Special Correspondence.

MEXICO.

Pachuca.—La Blanca Bonded. — Big Dividends. — Batopilas Production.—Discoveries near Ocampo.

Special interest has again been drawn to Pachuca, the famous old camp in the State of Hidalgo, by the recent report that a 90-day option has been taken and that examinations are being made by John B. Farish on the La Blanca property. The price is placed at ₱8,000,000. The excellent results obtained by A. F. Holden and associates (or the United States Mining, Smelting & Refining Co.) from the Real del Monte properties has caused many others to look with a jealous eye in that direction, and La Blanca has been mentioned several times as being under option and examination since the sale of the Real del Monte. It is to be hoped that a strong foreign company may get hold of La Blanca, for it is one of Pachuca's largest properties, and it is claimed that ore to the value of ₱30,000,000 has been blocked out. However true this may be, it is certain that, handled on a large scale, it would give excellent returns on a capitalization as high as the Real del Monte, which has paid dividends exceeding ₱1,500,000 in the last 12 months. In addition to the above-mentioned properties, all the others at Pachuca seem to be in excellent condition; the Sorpresa, Soledad, and San Rafael-Trompillo, may be considered in bonanza; they are paying excellent dividends; the San Rafael is approaching completion on two new stamp and cyanide-mills, the San Rafael and La Union, the former in fact being partly in commission. When wholly completed they will treat 600 tons between them—350 tons per day of mine-filling, dump and low-grade ore at the San Rafael, and 250 tons per day of the higher grade ore at the La Union. The Santa Gertrudis, which has been a dividend-payer for 35 years, having had ore at 90 ft. from the surface, is stated to be now in bonanza on the 17th level at a depth of 500 metres, where they have driven over 300 metres on a 12-m. vein which yields shipping quantities up to 4 kg. and over of silver per ton. The San Antonio, one of Pachuca's new mines, has opened up, at a depth of 100 metres, a 5-m. vein of 1-kg. ore, but it is the intention of the company to sink to a depth of 200 metres before doing systematic development. The Sonora & Urés Co. is another new company which is sinking near La Blanca and the Santa Gertrudis; and the Pachuca M. Co., Ltd., is a new ₱1,000,000 concern which has been formed to operate on some 50 pertenencias near the Santa Gertrudis.

Chihuahua continues to be the centre of some of the most important old and new work in the Republic. The Batopilas mines, in the western part of the State, which since 1880 have produced over ₱22,000,000, are again in excellent condition, the production in both December and January reaching over ₱200,000, and for February and March, ₱300,000. The entire product is shipped out as bullion from the stamp and amalgamation mill and goes to Philadelphia, but a cyanide plant is now to be added, and it is believed that much of the ore that cannot now be profitably treated will give a nice profit from cyanidation. The Rio de Plata and the Republica, also in the great mineralized region of western Chihuahua, are keeping up production of high-grade concentrate and getting settlements from the smelters of something over ₱40,000 per month. Both properties have been greatly hampered in the running of the mills and in the installation of the cyanide plants because of the unusual lack of water, which has been a serious question this year. Up to the present there have been none of the late winter and early spring rains that are so necessary in this country, where there are no heavy snows to melt and fill the creeks and streams. Another comparatively new field is that around Uruáchic, to the south of Ocampo and Pinos Altos, where a good grade of lead and copper ore running well in gold and silver is being developed. Small but rich shipments are being made by T. A. Ripperdan and E. Rascon. The former has organized the American-San Timoteo Mining & Smelting Co., and will endeavor to put a small smelter on the property, as there is plenty of ore besides his own which could be profitably handled by a local smelter, but could not stand the ₱50 transportation charge from the mine to the railroad, with other freight and smelting charges added to that. The most noteworthy and remarkable work of the past year is that of J. S. and Charles Qualey at Yoquivo, not far distant from Uruáchic, on the San Francisco mine, held under option at a low figure from Enrique C. Creel, governor of Chihuahua. With only a windlass they have opened a strong quartz vein giving shipping quantities as high as 20 oz. gold and 1500 oz. silver. In addition to several hundred tons of lower-grade ore on the dump, they have shipped five car-loads, giving a smelter return of ₱25,000 on the first car-load and twice that on the fifth car of 60,000 lb., or ₱1 per pound. The Qualeys are now installing hoisting machinery, and promise the people of Chihuahua shipments of enormous value.

CHICAGO.

Dering Receivership.—Steel Corporation's Fuel Policy. — Coal-Land Value.—Fuel Conference.—Mine Accidents. — State Geological Surveys.—Wisconsin Lead and Zinc.

The Dering receivership continues to be the leading topic of conversation among Chicago coal men. Because of the light shed on coal matters in general, and on the policy of the U. S. Steel Corporation in particular, it may be of interest elsewhere. Nominally the Dering Coal Co. was put into the hands of a receiver, W. C. Niblack of the Chicago Title & Trust Co., because of the failure of certain subsidiary companies of the U. S. Steel Corporation to pay a certain $215,000 claimed in disputed settlement, and needed by the coal company for meeting interest charges on April 1. It seems that the Dering Coal Co., having taken a 50-year contract to supply the Steel Corporation with steam-coal, finds the price too low, and the contest is between H. C. Frick demanding his pound of flesh, and R. R. Hammond attempting to save something for himself and fellow stockholders. The mines concerned are near Danville, Illinois. Some years ago Mike Kelley, a vigorous and picturesque character, developed this field, and obtained large contracts for supplying 1,000,000 tons per year, to the Illinois Steel Co. It is the field nearest to Chicago of any having thick and cheaply mined coal. The mining rate there has been a disturbing factor, and is now the basal rate in labor settlements throughout Indiana and Illinois. Kelley died wealthy, and left his property to children who have squandered the proceeds of bond sales in royal style. The stock passed



The Patio Process at Pachuca.

into the hands of the McKinley traction interests, and the contracts were undisturbed. Adverse conditions, however, took out most of the profit, and when a few years later the Dering, a newly organized competing company, offered a price of 10c. per ton lower, no great regret was expressed. Soon after, in order to fill the contract, the Dering interests took over the Kelley Coal Co. This was later put through a receivership, and has just been bought by the Hammond Coal Co., an affiliated organization which controls the newer and better properties of the Dering company. Things have gone from bad to worse in attempts to fill the contract with the Steel Corporation. The coal is delivered to the latter at the mines, the steel company running its own trains over the Chicago & Eastern Illinois railroad to South Chicago. This season it is stated that coal has been sold as low as 78c. per ton, and even with prospective demands for 10,000 tons per month, this meant ruin. For some weeks the Steel Corporation and the coal company have been unable to agree on dockage charges, and the former has been buying wherever coal could be found on 30-day contracts. Since, however, this involves paying normal railway rates in place of 15c. per ton 'running rights', it is evidently a temporary expedient. Either the Steel Corporation must give Mr. Hammond and his associates a new contract at more remunerative rates, or it must bid against him and purchase mines of its own. Some interesting jockeying is evidently in prospect.

Incidentally, an interesting side-light on coal-land values is cast by the statement of the petitioners that the coal company has property reasonably worth $6,000,000 represented by 200,000,000 tons of marketable coal in the ground. The low value of the coal, well situated for mining and marketing, and of good quality, is a striking commentary on the large amount available in this field, and the present unsatisfactory conditions of the coal market.

Evidence of the latter is also seen in the failure of the proposed combination of mines tributary to East St. Louis. Last week mine-run was offered there at 65c. per ton f.o.b. at the mine. Much has been sold this winter at 80c. At the latter price operating expenses are just about cleared, leaving nothing for interest charges or profits. This seems to be due to the presence of short industrial railways owned by certain of the mining companies. So long as the market can be controlled with a single locomotive, it is not necessary to consider mine-profits. Railway rates have been frozen stiff by recent legislative enactments against rate-cutting and rebates, and there is a fine profit in a railway haul at 42c., when formerly the actual rates paid, taking into account rebates, fell as low as 10c. without putting any road into the hands of a receiver. Just now the pay-rolls at many mines are met on borrowed money, and many banks are carrying oft-renewed notes of coal companies. Unless conditions change for the better, a number of additional companies will undoubtedly go into the hands of receivers.

All this bears on the anthracite strike-question. Nearly everyone concedes that there is insufficient ground for a successful strike, and that the time is most unfortunate for the miners. Few think a bona fide strike will occur. A strike there means temporary prosperity to both operators and miners in the fields of the Middle West, where so many men are nearly desperate.

A Fuel Conference was held at the State University, Urbana, Illinois, last week. The occasion was the opening of the new mine-rescue station, which is a co-operative enterprise, supported by the University, and the State and U. S. Geological Surveys. The conference was well attended by representatives of the miners, the operators, the Survey-officials, and State Mine Inspectors from Indiana, Illinois, and Iowa. Mine-accidents, smoke-prevention, and fuel-economy were discussed in numerous papers, and resolutions were passed calling for future conferences, and for a mining department at the University. The situation in the latter particular is anomalous. The trustees of the University are asking this year for $1,000,000 for experimental work in agriculture, but refused the modest request of Dean Goss for $25,000 for mining work. With an annual mineral-output of $150,000,000 it would seem that the mining interests of Illinois were entitled to more consideration.

Mine-accidents continue with alarming frequency. The last was at the Sunnyside mine, in Evansville, Indiana, where on March 20 five men were killed by an explosion caused by a 'windy shot'. Since 26 men escaped, there is a general feeling of relief. R. Y. Williams, of the Urbana Mine-Rescue Station, went promptly to the scene of trouble.

The Geological Surveys are busy with plans for the summer. It is understood that the U. S. Geological Survey will need a number of additional men. Frank W. DeWolf, Assistant State Geologist, has been made Acting Director of the Illinois Survey. Mr. DeWolf has had charge of the coal-work for both the State and the Federal Surveys in their territory, and is a competent man, whose selection for the post will be generally approved. In Indiana the Legislature not only did not follow the recommendation of Governor Marshall that the office of State Geologist be abolished, but actually increased the appropriation. In Missouri, Governor Hadley sent a special message to the Assembly, calling attention to the good work of the State Survey, asking for a larger appropriation, and urging that the State Mine Inspectors be appointed by the State Geologist. There is no question that mine inspection in Missouri has been lax. How far the proposed change would be helpful is open to question.

Later developments in the Wisconsin lead and zinc mines seem to show that the peculiar form of orebody found there, known as 'flats and pitches', extends below the 'glass-rock'. It has been known for some time that important orebodies were found at that lower horizon, but where first opened they were irregular and hard to follow. The new development will make mining more certain.

SALT LAKE, UTAH.

Conference of Lead Producers — Memorial to Congress. — Mascot Tunnel.—Ohio Copper Co.—New Concentrator.

A conference of lead ore producers, called together by J. F. Callbreath, secretary of the American Mining Congress, was held at Salt Lake City on March 22 and 23. It was attended by over twenty mine operators from Utah, Idaho, and Colorado, who organized the Western Lead-Ore Producers' Association. The object is to protest against the proposed reduction by Congress of the import duties on lead in ores, and upon metallic lead. Harry L. Day presided and Geo. W. Riter acted as secretary. Brief speeches were made by W. F. James, of Salt Lake; C. E. Loose, of Provo; I. E. Rockwell, of Hailey, Idaho; C. E. Allen, Geo. W. E. Dorsey, H. S. Joseph, and Geo. W. Riter, of Salt Lake; M. A. Folsom, of Idaho; and J. F. Callbreath, of Denver. A committee on resolutions, comprising J. F. Callbreath, W. Clayton Miller, M. A. Folsom, J. W. Knight, and Jackson McCrystal, drew up a memorial for presentation to Congress, which was adopted by the Association, emphasizing the importance to the lead mining industry of a protective tariff upon lead and lead-ores, and calling on the party in power to redeem its pledge, made before the last national election, to maintain a tariff on all products sufficient to balance the difference between the cost of production here and abroad. The future work of the Association was left to the discretion of an executive committee, consisting of H. L. Day, W. D. Hoover, J. F. Callbreath, Geo. W. Riter, and Ernest Bamberger. It was decided that the lead-mine operators of the several States should send a representative to Washington to work in the interest of retaining the present tariff rates, namely 2⅛c. per lb. on pig lead and 1½c. on lead in ores. Among the operators in attendance, in addition to those mentioned, were Jas. F. McCarthy, of Wallace, Idaho; Samuel Newhouse, B. N. Lehman, M. C. Morris, Grant Snyder, W. B. Fisher, Matt. Dougherty, John McCrystal, and A. W. Scott, of Utah.

The mineralized zone of the Ohio Copper Co., in Bingham district, has an easterly strike, and a dip to the north of about 45°. It is a zone of mineralized quartzite more than

500 ft. wide, adjoining porphyry on the north. This belt of quartzite contains two parallel veins, in each of which the ore is high-grade, and participates in the same strike and dip as the general zone. These are known as the What Cheer and All's Well veins; the former is on the south border of the belt, near the contact of the quartzite with the porphyry; the latter is on the northern border, and appears to have a hanging wall of porphyry. The two veins are more than 500 ft. apart, the material between them being solid quartzite, carrying sulphide of copper, said to assay 1.6 to 1.8%. In the earlier period of the mine-development a cross-cut adit was driven 600 ft. from Bingham canyon, intersecting the What Cheer at 100 ft. from the portal, and opening the All's Well 500 ft. farther on. From this level drifts were run on both veins, raises were made on the ore, stopes opened, and a considerable tonnage of high-grade ore was shipped, much of it being cuprite. While ore from these veins is rich, the paystreak is narrow, ranging in width from 6 in. to 3 ft. Later a 400-ft. winze was sunk on the All's Well from the main cross-cut level, and from this winze extensive development was done on the 400 and 500-ft. levels, the main cross-cut from the surface being considered the 100-ft. level. This winze is now abandoned, as other provisions have been made for reaching the deeper levels. Recent development consists of a 1400-ft. incline-shaft which starts in the foot-wall of the What Cheer vein and terminates in the quartzite and porphyry between the two veins. This shaft has an inclination of 50°, is two-compartment, with track for a skip in each. The shaft is timbered to a depth of 1100 ft., and the work of timbering the last 300 ft. is now in progress, the tracks for the skips being extended as fast as timbering proceeds. The incline connects with the Mascot tunnel, and the lowest 300 ft., which was a raise from the tunnel-level, was recently completed. The workings on the 100, 400, and 500-ft. levels have been connected with the 1400-ft. incline. On the 100-ft. level is a mineralized area 500 ft. square, which has been blocked out. It is stated that the development on the 400 and 500-ft. levels is almost as extensive. Ore from the lowest workings, where the incline connects with the Mascot tunnel, seems much the same as that where the development is greatest in the upper workings. The Mascot tunnel starts on the Salt Lake valley slope of the range, taking a westerly course for over 14,000 ft., cutting into the foot-wall of the All's Well vein and running parallel with it through the ground of the Ohio Copper Co. The last 1200 ft. of this tunnel was driven within the last year, and the part which was originally driven as far as the Dalton and Lark areas has been enlarged so that the entire bore now has a section 7 by 7 ft., except that there are three 500-ft. switches where it is broadened for double tracks. The grade is 0.58% for the first 9000 ft., and 0.42% for the remainder of the distance. The track is laid with 40-lb. rails, a box-channel or sluice below the ties serving to drain a large volume of water. The raise that was made from the tunnel-level to meet the incline-shaft was surveyed by Frank B. Goodman, one of the engineers of the Ohio Copper Co. The survey was checked by J. E. Bergh, and the exactness with which their calculations agreed was evidence of the skill of both. The plan is to develop the zone on the level of the Mascot tunnel in a manner similar to that on the upper levels, and to make three raises from the Mascot level to the 100-ft. level, and take all ore out through the tunnel in 4-ton cars. This contemplates a system of levels and raises from the 100 to the 1400-ft. level, representing a vertical depth of 1000 ft. At the mouth of the Mascot tunnel is a smooth open country, where is situated the air-compressors, the concentrating mill, administrative offices, and the town of Lark. It should be stated that the Mascot tunnel is the property of the Bingham Construction Co., the stock in which is owned by F. A. Heinze and associates, Mr. Heinze being a heavy shareholder in the Ohio Copper Co. The mill for concentrating the ore of the Ohio Copper Co. is still unfinished. The steel building, 350 ft. square, is covered with corrugated iron and lined with asbestos. The necessary concrete blocks for the machinery are now complete. The equipment has been bought, and much of it has been delivered, but not installed. The plant will have crushers, rolls, Chilean mills, jigs, tables, and vanners. Its capacity is figured at 2250 tons of ore per day. It is said the work of installing the machinery will proceed at once, and will be ready for operation July 1. The mill has been largely patterned after that of the Boston Con., at Garfield, Utah. The big mills of the Utah Copper Co. and Boston Con. operate almost exclusively on copper ores having a porphyry gangue, but the Ohio Copper Co.'s mill will treat almost wholly a copper-bearing quartzite, which will not slime so readily. On the operating staff of the Ohio Copper Co. are Colin McIntosh, general manager; Felix McDonald, mine superintendent, and Frank Jones, mill superintendent. James McFarland is president of the company.

DENVER, COLORADO.

Development in the Sulphide Belt. — New Companies. — Gunnison Tunnel.—Denver Coal-Field.—Altman Leasing Contract.

Seldom has Denver been so completely cut off from other centres as by the blizzard of March 25. Railroad traffic was paralyzed, and telephone and telegraph lines were down. The whole northern part of the State was affected. The prevailing warm weather, however, makes the delay in development work only temporary. Almost every proposition



Western Colorado.

in the sulphide belt that has any merit has resumed development, and an active season is assured. The initial trial of the Sigafoos tunnel-machine took place at the Georgetown tunnel, on Columbia mountain, March 24. It was the first trial under working conditions. Heretofore the company had been unable to secure water to clear away the muck. The trial lasted 15 min., and the machine advanced steadily at the rate of 1 in. per minute.

Two new companies have been formed which should have a beneficial effect on mining and irrigation. The Great West Consolidated Mines Co. has been incorporated, with Ross MacDonald as president. This company has secured control of the Little Pittsburg group of claims, in Saguache county; the United States Navy gold and copper claims, in Chaffee county; the IXL and Pewabic mines, in Gilpin county; and the Nebraska mines, near Silverton. The other new corporation is a power and irrigation company, which has filed plans for the construction of three reservoirs on the Cache la Poudre river. The pipe-lines and ditches from these reservoirs will supply water to 149,800 acres in Larimer, Logan, Weld, Yuma, Adams, and Boulder counties. Power-stations will also furnish electric power to mines and tramways in competition with the Northern and Central Colorado Power companies. The Penn-Wyoming Copper Co., which recently got into financial difficulty, has

been absorbed by the United States Smelters Railway & Copper Co. The holdings of this company now consist of the Ferris-Haggerty mine, Saratoga & Encampment railroad, Southern Wyoming tramway, Doane-Rambler mine, and the Encampment smelter. The consolidation of these concerns under one management should prove of benefit.

Prospectors are busy in the mountains west of Montrose, and land speculation is booming in the Uncompahgre valley on account of the completion of the Gunnison tunnel, which is to be dedicated by President Taft on August 16. The tunnel will furnish water to 150,000 acres, and before the water is let into the river again it will generate 20,000 horse-power.

During the summer of 1908, members of the U. S. Geological Survey made a detailed study of the coal-field on the eastern slope of the mountains in Colorado. The limits of the Denver coal-field were found to be from near the Wyoming line south to include the Colorado Springs coal-field, and to extend east from the foot of the mountains, for about thirty-three miles. Although no outcrops of coal occur between Denver and Colorado Springs, there is reason to believe that good coal will be found between these two cities, under considerable cover. The work on the Colorado Springs field was done by Marcus I. Goldman, under the general supervision of G. C. Martin, who had charge of the investigation as a whole. A bulletin of the survey will soon appear covering this subject.

Leases in general admit of much variety in point of terms and conditions specified, but it is uncommon to find one which reserves the upper part of an extensive claim-group and gives to lessees the right to mine below their lowest level. Such an undertaking has been made the basis of a five-year lease recently given to the Altman Leasing Co. by the Free Coinage Gold Mining Co. on their 30-acre tract, beginning from the horizon of the 550-ft. level of the Pinto shaft, downward to any depth to which the lessees can carry operations within the time-limit. This is conditioned upon sinking the main shaft several hundred feet deeper. It is a good example and a practical expression of confidence in development of ground that is central to some of the richest parts of the Cripple Creek district, lying, as it does, between the Isabella mine and Vindicator groups on Bull Hill, about the town of Altman.

The Free Coinage Gold Mining Co.'s property includes the vein-systems of the Pinto-Pharmacist, Wilson, Pinto-Bison, and Pueblo mines, and is among the successful companies of the early days of Cripple Creek; it is now being actively worked at several levels, all under the leasing system. Since 1894 this group has produced from 1¾ to 2 millions of dollars, from workings that are superficial as compared with those of its neighbors. Among the latter are the Isabella and Findley, which reach depths of 1100 and 1400 ft. below the collars of their respective shafts.

The Altman Leasing Co. is installing a powerful Vulcan geared hoist, of capacity to reach to a depth of 1500 ft., which will take the burden from the present equipment before it reaches its limit. Combining the features of large acreage with its location in the midst of the most productive mines of a rich section, there is probably not a similar mineral tract in the district that can be leased in a compact group. In addition to the main 'deeps' lease, this leasing company has two blocks above the 550-ft. level, in one of which high-grade ore has been discovered through prospecting upon the Black dike of the Bison claim, which corresponds with the Isabella dike of the Government report upon the mines of this portion of Bull Hill. Air for machine-drills is taken from the Union Leasing Co. from the plant at Deadwood. At first a small force is being employed in shaft-sinking and in prospecting. Extensive drifts and cross-cuts make available to stoping much promising ground, without costly outlay in dead-work. The management is enthusiastic over the prospect of early shipments. The new company is organized under the laws of Colorado, with a capital stock of $100,000. The principal office will be maintained in Cripple Creek. Geo. R. Woodin, of Boston, is the moving spirit of the enterprise.

NEW YORK.

Zinc and the Tariff.—Senate Tariff Bill.—Exchanges and Gambling.—Concheno Mine, Mexico.—Cobalt Stocks.—Mill at Pioche.

Zinc smelters are greatly alarmed by the Payne tariff bill. The largest smelters mine and import zinc ores as well. They are compelled to do this through the necessity of keeping the smelting plants in regular operation. Owing to the all-round changes it is proposed to make in the tariff zinc smelters will feel the effects in all their operations, and in some cases they may be compelled to discontinue smelting, which, they claim, is not the most profitable part of the zinc industry.

The Payne bill proposes to change the duties on spelter from 1½ to 1c. per pound; of sheet-zinc from 2 to 1¼c. per pound; and to place a duty of 1c. per pound on zinc in ores. The average price of spelter in Joplin in the past 10 years amounted to 5.05c. per pound. Owing to the general appreciation in prices it is not unreasonable to expect the average price, if no tariff changes be made, will in the immediate future range near 5.25c. per pound. With an increase in ore-costs the smelters' margin of profit is liable to be wiped out.

Smelters complain that they are menaced by a restricted consumption of spelter, competition of foreign smelters, and a shortage of a suitable domestic ore-supply. They do not ask for a prohibitive duty on spelter, but for a reasonable one. A prominent smelter expressed the opinion that a 20% *ad valorem* duty would be considered reasonable. No objection would be made to a sliding *ad valorem* duty, increasing and diminishing in accordance with the price of spelter in New York or Joplin. When spelter is 5c. per pound the duty would be raised to the maximum and reduced in proportion to the advance in the domestic price. The main concern of the smelters is to see the duties arranged in a sufficiently flexible manner to enable them to keep their plants in steady operation.

There should be hope inspired by the advices from Washington to the effect that the tariff bill prepared in the Senate will be the real bill, and that its provisions will be far more conservative than those in the Payne bill. It is currently affirmed that the report of the New York State Commission, which recently investigated the various exchanges, including the New York Stock Exchange, will exonerate them from blame in the matter of stock gambling. Whatever gambling in stocks is carried on is not within the precincts of the exchanges. The grand jury and the district attorneys should concern themselves with such gambling. Notwithstanding the severe way in which the chairman of the Exchange Commission expressed his opinion regarding the fixing of the prices of metals on the New York Metal Exchange, that institution continues its old practices. The prices of copper, spelter, and other metals and metal-products are fixed, as formerly, in correspondence with the fluctuations in London prices. Some of the members of the Exchange are endeavoring to form a new exchange, where some freedom of competition in price-fixing would be permitted. There hardly seems room for a new metal exchange.

Henry Ide Willey, president of the Humboldt Exploration Co., who is at present at Chihuahua, Mexico, has denied the reports regarding the taking of options upon the various properties in Mexico that belonged to the Greene Gold-Silver Co. Mr. Willey states that he is concluding arrangements to take over the Concheño and other mines formerly owned by the Greene concern, for the benefit of the stockholders of that company.

Notwithstanding that Cobalt stocks have been dull in New York during the past half-year, a number of Canadian companies operating mines at Cobalt are making arrangements to list their stocks on the New York and Boston curbs. Preparations are also being made to bring out some new Cobalt issues in New York shortly. It is believed that the improved outlook for silver in the Orient, and commercial prospects in America, warrant the belief that mining investments will again become popular within the next few months.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Resistance to the solvent action of acids may be increased by certain elements added to alloys. Acid-resisting alloys possess either a high content of lead or antimony. Silicon is added to cast-iron in order to effect the same end.

Silver retains its whiteness in spite of large admixtures of copper; in fact, it only begins to acquire a yellowish tinge when the proportions are 6 of silver and 4 of copper. The hardest alloy of these two metals contains 312.5 parts silver and 687.5 copper.

Guide vanes are advantageously fitted to the interior of hydraulic giants to prevent a scattering or rotary motion of the water after it has issued from the nozzles. They tend to discharge the water in a solid and columnar form, thereby largely increasing the effectiveness of the stream for hydraulic mining.

Smelting of black sand for iron is economically impossible in the blast furnace. Fine ores are always objectionable in blast-furnace practice, owing to the enormous loss in the dust carried off by the flue-gases. The electric furnace, however, opens a new field, the utilization of fines being feasible under the conditions there presented.

Garnet sands, found in such great quantities at Nome and other places in Alaska, do not lend themselves to commercial exploitation because of the great amount of garnet available for use as an abrasive nearer the centres of consumption, as for example in Raburn county, Georgia, and in Burke county, North Carolina, where extensive deposits are worked.

Friction in crushing ores, either wet or dry, develops enough heat to promote oxidation of susceptible substances. For example, FeO is to some extent oxidized to ferric hydrate, and sulphides of iron and copper are oxidized to sulphates. The amount of such oxidation-products is by no means negligible in the subsequent metallurgical treatment of gold and silver ores.

Saving of black sand from beaches has not proved a practical success in any part of the world. The difficulty is that the black sand is seldom free enough from iron-minerals containing other elements to be valuable as an iron ore. A few such deposits exist, and a remarkable one is reported from the east coast of the island of Martinique, in the Lesser Antilles, stretching for several miles along the beach not far from the base of the volcano of Peleé.

Polished gems generally develop high electric properties by being rubbed on cloth. This is particularly true of the topaz, and is a notable characteristic of the diamond, either in the rough or when cut. The topaz becomes electric by the application of heat; this property of becoming pyro-electric is shared by tourmaline, the latter mineral developing polarity, attracting and repelling on opposite sides, as may be tested by the needle of a compass. Zircons, sapphires, and rubies are non-electric. Quartz may be distinguished readily in the field by rubbing two pieces together, when the peculiar odor known as 'fire-stone' smell is given off.

German cement manufacturers are tending to less severe specifications, while American specifications are all in the opposite direction. In Germany an Association of Portland Cement Manufacturers makes regulations which are generally accepted, just as the specifications of the American Society of Civil Engineers rule in this country. One may be suspected of bias, the other is interested only in safety and durability. The following requirements show the comparatively easy task of the German cement manufacturer: 3% of set-retarder permissible; for fineness, No. 76-mesh screen is used, on which 5% of the sample may remain; tensile strength, 3 sand to 1 cement, at 28 days, 224 lb. per square inch. Corresponding American requirements are 2%, 5% on 100-mesh, and 300 lb. tensile strength.

Antimony ore will not be accepted by the smelters unless it contain at least 50% of that metal. The specifications, furthermore, demand freedom from arsenic and lead. These conditions are usually difficult to meet. The economical separation of gold and silver from antimony is not simple. A process of alternate roasting and reduction of the ore, mixed with charcoal breeze, will eliminate antimony by volatilization, and in certain cases should leave a residuum containing the precious metals, which could then be treated by other means, if other base metals do not interfere. In fact, by such a process the presence of lead can be turned to advantage by the metallurgist in collecting some of the precious metals, if the lead be present in sufficient quantity. This work can be done in a reverberatory of the Bleiberg type with sloping hearth.

Graphite is so abundant that only special qualities, or favorable situation, can justify exploitation. Any deposit of magnitude, however, is worthy of careful investigation. Graphite of different degrees of purity and of different textures is needed for special uses. The classifications are too many to be explained here. The purity of the graphite flake itself is a matter quite distinct from the association of the graphite with gangue. The graphite, after concentration from the matrix, needs to be tested as to its merchantable quality. The concentration of this substance presents some peculiar difficulties, and even these vary with the deposits. In general, successful results can be obtained by crushing to the 'critical size,' that is, the coarsest size which will liberate the major part of the graphite, jigging, classifying to float off as much fine graphite as possible, re-grinding the settled material, re-jigging, and so on until the residue is too fine for jigging, when various methods of hydraulic classification and elutriation are relied upon.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Tailing-Wheel v. Pump.

The Editor:

Sir—On the lines of Mr. Peele's communication in your issue of February 13, it is interesting to note that some ten years ago we made an attempt to use an air-lift for raising tailing in the Standard mill, at Bodie, California. The operation was satisfactory as long as the whole mill was running, but if five stamps were hung up, the lower end of the uptake pipe soon became blocked. This was because the decrease in velocity in both submersion pipe and uptake allowed the heavier particles to settle and close the entrance to the uptake. Under normal conditions the downward velocity of the current in the submersion pipe was sufficient to scour the accumulation away, and the upward velocity in the the uptake was calculated so as to be greater than the falling velocity of the most quickly falling particles. With decreased flow, however, both velocities fell, the nice balance was destroyed, and blocking resulted. The mill was of only 20 stamps, and it was essential that the lift should operate when only 5 heads were dropping. Accordingly, if we had diminished the diameter of both submersion and uptake pipes so as to give the proper velocity of flow for the minimum amount, the velocity would have been four times greater than necessary for the greater part of the time with 20 heads dropping. This meant greater friction and more air required. Accordingly, the device was abandoned and replaced by Frenier pumps.

R. GILMAN BROWN.

London, March 4.

Short Zinc.

The Editor:

Sir—In your issue of February 13, page 246, you refer to the ill effects of iron present in zinc used for gold-precipitation purposes. This opens an interesting subject. The phenomenon of 'short-zinc' so-called—the rapid crumbling or disintegration of zinc-shaving—has been observed under varying conditions. My own observation would point to its being due in most instances to the presence of iron, not, however, so much in the zinc itself as in the solution, and in the material of the zinc-box. I do not think the small amount of iron in the better grades of commercial zinc can be appreciably detrimental. The worst case of short-zinc I ever saw was in a plant where I was treating a deposit of old oxidized tailing, full of soluble iron salts. The solutions were reddish-brown in color. Here the consumption of zinc was alarming, while zinc supplied by the same firm was perfectly satisfactory in other cyanide plants in the same district. In the case referred to, the shavings would become so brittle after an immersion of an hour or two in the solution, that they could be compressed in the hand into a hard compact mass of short-zinc. This was doubtless due to the galvanic action set up between the zinc and the iron. I have seen zinc crumble badly in boxes made of iron, where, at exposed points not covered by protective paint, a small line of bubbles could be seen issuing from the unprotected surface. The complex chemical reactions and galvanic phenomena of zinc-precipitation have not received as much attention from cyanide chemists as they deserve—possibly because, as a rule, in practical work precipitation offers no serious difficulties. Until this subject is more definitely understood it may spare the operator some trouble if he will remember to keep zinc and iron as far apart as possible in his precipitation boxes. In the meantime it would be interesting to know something more of the experience and researches of metallurgists in zinc-box work.

F. L. BOSQUI.

San Francisco, February 24.

Protecting the Investor.

The Editor:

Sir—Anent the recent discussion in the Mining and Metallurgical Society concerning measures for the protection of the public, there will doubtless arise the various difficulties that hamper most reform movements. One of these that seems just now coming above the horizon is the conflict between the desire to enforce high ideals and the necessity for exercising the virtues of patience and tact in striving for their realization. "The over-valuation of mining properties by investors and the public, due to ignorance of mining conditions and a lack of appreciation of the real nature of the investment," with the serious abuses that have grown up in consequence of these conditions seem to demand not only a frank statement of all available facts and estimates in every mine report, but also the fullest possible interpretation of such data with reference to the mine's present status and future prospects. Of course, there is a large class of mines, falsely so called, whose shares are sold widely over the country, as recently pointed out by Mr. Merrill in these columns; and one of the most difficult tasks that confronts the Society in its campaign for the square deal to the public is that of enlightening the people on the distinction between a mine and a mere prospect. As I understand it, however, the Society is developing the less refractory vein first and the one that seems to promise more speedy returns, namely, the relations of the real going mine to its stockholders.

Surely it is to the interest of the mining industry in every way, and particularly as regards its standing in the public estimation, to combat the prevalent idea that mining is but an aggravated, although somewhat picturesque, form of gambling. The sooner a mine comes to be known and dealt with as a tangible asset the better for all concerned in real mining. This category, of course, does not include the professional speculator and inflator. These are the parasites of the industry; and parasites are not

only a source of discomfort—in civilized society they are a positive disgrace.

While we cannot yet weigh a mine and affix a price to it as if it were a packet of tea, still it is possible to arrive at a valuation on a perfectly rational basis. The public should not only know this, but should be able to take advantage of the results, with the clear understanding, of course, that such a valuation is only an estimate, and that various assumptions as well as known facts are involved in its computation. If a mine cannot reasonably be valued above $500,000, and this fact is ascertainable on competent authority, there is little danger of the percolation of 'meteoric waters' into it to the extent of $5,000,000; and such 'magmatic waters' as may have attended its intrusion into the upper strata of finance will be quickly eliminated by the normal processes of cooling and crystallization.

A good mine report should certainly include a statement of ore reserves, and the stockholder may also reasonably demand an estimate of the probable life of the mine. This information furnishes a basis for some sort of conception of the mine's actual value. Otherwise these are matters of little interest or importance to the public. It may be contended, however, that to stop at this point is to defeat, in a measure, the main purpose, so far as the investor is concerned. He will read of ore reserves and life of the mine with only a vague conception of their real significance; and he might well inquire, in the language of the street: "What's the answer?" It is no reflection on the average intelligence to say that few, even among competent business men, can properly comprehend such data. The services of an expert are required, and the stockholder may contend that he should not be obliged to employ an engineer to interpret the company's report for him. It may justly be said, however, that a demand for an annual valuation under present conditions approximates too closely a counsel of perfection, and would be little heeded, even if it did not arouse opposition to more moderate requests. Reform is not revolution, and any suggestion looking toward improvement on present practices must, in order to be effective, commend itself to hard-headed men of affairs who are in much closer touch with existing conditions than with ethical ideals. Hence, it would be a rational policy to make the present practice of the best companies the basis on which to build.

Of the three requirements that have been suggested for an ideal mine report, namely, (1) a statement of ore reserves, (2) an estimate of the life of the mine, and (3) a valuation of the property, the first is already met by various well-known companies, and it is not at all inconceivable that some of these might be persuaded to add the second also. We could then afford to wait long and patiently for the third.

With this much accomplished and a high precedent set for the less communicative, not to speak of the less righteous, organizations, a great step will have been taken toward the correction of the terrible abuses and the extermination of the pestiferous parasites with which the mining industry and the public are now annoyed. All legitimate mining interests will surely assent to the desirability of these reforms. Is it too much to hope that enough of them to accomplish great results may be brought into agreement as to the most effective methods?

J. VOLNEY LEWIS.

New York, March 3.

Chances for the Prospector.

The Editor:

Sir—I have just received a newspaper clipping from Dawson about gold on the Firth river, up on the Arctic coast of this continent, but it has all been staked ere this, if it is worth it. Some 11 years ago a man came to me with a tale of gold on this same Firth river, when only he and one other knew of it, and I have three times been the recipient of this before-hand information. One quiet tip took me into a far-away country, where we found ancient diggings and a brass musket, but no gold. One was given me because I was a surveyor and the miners wanted to know where the boundary line was and this took me into the Yukon in the early days. The third I need not mention, as it is not of these trips I wish to deal. The long tramps and wasted years have taught me to discriminate, and have led me to have in my own mind convictions and feelings as to where the next gold strike and stampede would be. Such prophesying may sound foolish, but it comes from a knowledge of the mining business, and proceeds by a process of elimination.

In general, grant that every piece of territory on the face of the earth the size of a State has gold in it, provided it is mountainous and rocky. In turn each portion of the earth of that size and character has had its gold excitement—California, Idaho, Montana, Colorado, and others. Then eliminate all civilized parts of the earth that have probably been prospected, and see what is left. This will sweep away nearly the whole of the United States proper, Europe, and some more. I was in Georgia, North Carolina, and Tennessee in the years 1887, 1890, and in July of last year. Each time I was surprised to see the shafts, holes, and remains of wing-dams and hydraulic works those Southern mountaineers had made in the early days, 1830 to 1840.

Next, eliminate all the recent sedimentary regions, that is, the flat countries like the lower and middle Mississippi Valley. The next factor is accessibility and source of supplies. For instance, I label as inaccessible regions those where one is prohibited by government or is apt to be murdered by natives. This will eliminate more of the earth's surface, and one begins to get down to tolerably narrow confines. Then comes the most important elimination of all. Look up the history of the remaining territory carefully, going back to the days of the 'ancients', and you may learn some things that will show how important it is to do some discarding. For example: C. P. Campbell of Chicago told me that he had lately been working placer deposits in South America with poor success. Now Mr. Campbell is a good mining man, but he failed to read history. The ground was overgrown with trees some three feet in diameter,

and had the appearance of being virgin, but after installing expensive machinery he dug up the remains of old Spanish sluice-boxes, and quit. He says he can now identify the remains of ancient Spanish placer works by the peculiar shape of the surface, whether it is covered with a later growth of forest or not, and he has concluded that the Spanish Dons, each with a handful of armed retainers and a few hundred slaves, gave the whole of South America a good prospecting about the 17th century. So far as placer deposits and easy lode-mining are concerned, I should eliminate nearly the whole of South America.

I have at my home in Ohio seventeen large volumes in old English type, and very hard to read. They contain a history of gold mining in Africa up to the year 1750, and the information in those has led me to eliminate two thirds of Africa. Further to illustrate the process, let us consider Asia: Siberia was to me the worst disappointment. I was there a number of years ago, before the days of the concessionaires, when we were not wanted and took chances. If I had investigated the history of the region before I went, I could have saved myself some tramping. I will cite one passage: In a book called 'The Elements of Metallurgy', by J. Arthur Phillips, edition of 1887, it is said that "the remains of numerous mines have been traced by Gmelin, Lepechin, and Pallas on the southern and eastern border of the Ural mountains, and in them were found hammers and chisels of copper. These excavations are inferred to have been made by a nomadic people, probably the Scythians; and from the fact that no iron tools were found in any of them, we may conclude that these operations were before the conquest of Siberia by the Tartars, who effected the subjugation of that part of Asia about the year 150 B. C. * * * Smelting was effected by small furnaces made of red bricks. Gmelin found nearly a thousand such furnaces in the eastern part of Siberia. In the neighborhood of these furnaces were found large quantities of broken pottery, together with numerous heaps of scoria, which indicates that operations to a considerable extent had at some period been carried on in the same locality." And as for placer diggings, I will add that since the concessions many an American prospector has tramped for miles in Siberia and faithfully panned promising gravel that was probably worked some time B. C. This does not apply to the whole of it, but there are large areas to be eliminated.

It is a pity that some scientific society does not extract the information buried in history and compile it for the benefit of modern seekers after the king of metals. For the present it is best to keep out of the trail of the Queen of Sheba prospectors, the Spanish Dons, and the Portuguese explorers. What they, with their hordes of black slaves, left behind them can only be worked when we get the help of railroads and modern machinery.

On the other hand, even in seemingly hopeless countries, there are isolated tracts entirely unprospected, where the ancient gold-seekers were held back by hostile tribes. This accounts for some comparatively rich spots in Asia, South America, and Africa, profitable now on account of transportation and machinery, but they are not now and never have been bonanzas for the pioneers, or the lust for gold would have overcome the obstacles long ago, and the right to work would have been wrested from the savages, just as we forced the Sioux out of the Black Hills, and as the Spaniards subdued the Peruvians. When at the age of eighteen I first started out prospecting, I thought that nearly the whole world needed exploring, but I have since concluded that our forelopers, black, white, and yellow, have left but few corners untouched.

So we may eliminate the possible places for new discoveries of the magnitude of Ophir, Peru, the Gold Coast, California, Dawson, and Nome, down to a few thousands of square miles. And gold is not found by a dream. When it is discovered, it is because some man is there and digs it up. Of those who do the digging and discovering, that is, the true prospectors, those who can and will do nothing else, there are, in my estimation, only about 5000 in the world. I know this about as well as an old-time tramp printer could tell you how many other tramps there were on the road; a guess, but a fair one. Of the half-way prospectors there may be probably half a million. Falling back upon farming between seasons, they never get far from home and don't count heavily. In this connection I admit that it is not always the experienced prospector who makes the discovery, for it has often been some greenhorn drawn into the excitement, for whom they blazed the way and showed *how* at least, if not exactly *where*.

It is an interesting question what this bunch of dyed-in-the-wool prospectors is doing, and which way they are heading. With the present living members of the fraternity one can have but little more touch than with the dead and their secrets. We may learn that a few of them are heading in some promising direction—toward some really unexplored country. A letter from one or another of them now and then tells where a handful of them are. Thus I can keep tab on a few, but what their hopes and prospects may be is a question a 'cheechako' might ask, but a 'sour-dough' never answers.

H. H. Edgerton, Jr.

Laws, Inyo County, California. March 6.

Ozone is best prepared by the silent discharge of high-tension electricity through perfectly dry air. There are many devices for ozoning air, most of them being adaptations of the Siemen's ozonizer, familiar to all students of physics. The ozonizer at Wiesbaden was designed by Siemens and Halske. The air drawn into it is dried by contact with hygroscopic substances, as $CaCl_2$, or, preferably by refrigeration in a chamber cooled as in the freezing machines. The voltage required to operate this instrument is about 80,000, and the generator absorbs 1 hp. The amount of ozone produced varies from 13.5 to 27 gm. per hour, the rate of production depending on the dryness of the air which enters the apparatus. This quantity of ozone will purify from 2200 to 4400 gal. of water.

HOW IT STRIKES AN AMERICAN.—II.

Written for the Mining and Scientific Press
By T. Lane Carter.

In shaft sinking, they maul faster, if not cheaper, on the Rand than in America. As conditions vary so little out there, one shaft being about the same as another, they have acquired so much experience as to have their methods of shaft sinking down to a fine point. But faster drifting is accomplished in America. I could pick out remarkable records in drifting on the Rand, and could give instances of poor work in development in this country, but as a rule they drift more rapidly in America than in Africa. In recent years there has been a consensus of opinion that too many shafts have been sunk on the Rand, and that not enough material has been handled through them. The same thing applies to America. I think both countries have far too many shafts. To sink a shaft is an expensive operation, and it is therefore imperative to reduce the number in a mining district to a minimum. The only shaft I have seen in America to compare with the enormous holes being sunk on the 'deep deeps' of the Rand was the Red Jacket shaft at Calumet. They have adopted an entirely different cross-section in sinking their shaft, from the Rand section. In Africa a manager will sink a winze every time in preference to raising, while in America very little winzing, or winze sinking, is done, raising being the method adopted to get connections through. Labor for cleaning up the dirt is cheaper in Africa; therefore better work can be done there in winzing than in America.



The Camp Bird Mills, Near Ouray, Colorado.

For years the question of health among the underground workers has agitated people on the Rand. Commissions have been appointed to enquire into it, and many papers and figures bearing on the subject have been published. Laws and regulations have been passed to improve the health of the workers. For instance, it is now illegal to use a percussion machine in the mines useless sprays are employed to keep down the dust. Before shoveling dry ore, water is supposed to be spread over it to keep the dust down. From this it is seen that the dust problem in mines has been seriously tackled in the Transvaal.

Much attention has been given, and is being given, to the question of ventilation of the mines on the Rand. For some time past they have been debating whether 0.25 or 0.30 CO_2 should be the permissible limit in mine air. The question whether artificial ventilation should be put in has been discussed. All kinds of tests and analyses of air from the mines have been made at the Government laboratory. Explosives have been investigated, and the gases therefrom, in an attempt to improve underground workings conditions. A sharp outlook is kept for ankylostomiasis, or miner's worm, and other diseases which might attack the underground worker.

I found nothing like this solicitude over the health of the miner in America. After talking with medical men I came to the conclusion that there has not been the same cause for alarm in the mines of America as in the Transvaal, for the health here seems to have been better. The ravages of miner's phthisis or silicasis, which has played such havoc on the Rand, has never appeared to the same extent in America, according to the medical men I talked with. In no State did I find people exercised over the high death-rate of underground men, as they have been in the Transvaal, and this in itself is a proof that the mortality in the mines could not have been excessive. In no metal mines did I find artificial ventilation used to any extent, although it struck me that better use was made here of natural ventilation than on the Rand. Indeed, natural ventilation here is better because of the 'lay of the land'. Most of our mines are in mountainous country, where the difference in levels between two shafts may be such as to give a large motive column for the air. On the Rand the shafts are nearly on the same level. From what I

could see, they are not worrying much over here about the dust problem. The use of drills requiring water for their operation prevents dust where this machine is used. How to account for the high death-rate on the Rand, as compared with America, is a problem. Several possible reasons have occurred to me, to explain why it is that in the Transvaal the health of the underground workers has in the past been unsatisfactory. From what I could ascertain, the health of the American miner has in the past ten years been better than in the Transvaal. Why is this? In the first place, the negro race in America does scarcely any mining. Black men have a distinct racial tendency to pulmonary complaints. If only white men were employed in the mines of the Transvaal, under exactly the same conditions, the death-rate would go down. But the chief reason for better health among American miners in the past (and mind you, I am speaking more of the past ten years than of the present, for the new regulations will greatly improve the health of miners on the Rand) is found in the fact that the number of men employed underground is proportionately less than in the Transvaal. As a rule the veins in America are wider than in the Transvaal, and into this larger space fewer men are crowded. It is the same problem as an assembly hall. For one or two people the air is ample, but let a crowd pack the hall, and they will smother or become affected unless you resort to artificial ventilation.

Now that air-drills are coming into more extensive use on the Rand, it is probable that the number of men employed underground will be reduced. Judging from American experience, it seems that in the past the quantity of air in some of the mines on the Rand has been insufficient for the number of men. Had there been half as many in the mine, the quantity of air would have been sufficient. Another reason for the greater mortality on the Rand in the past exists in the character of the dust. It is sharper, and therefore more destructive on the lungs than the dust generally found in the mines of America. The Transvaal mines are materially drier. It speaks well for the Rand that the scientific societies and the medical men should be giving the question of the health of miners so much attention, and I should like to see the mines of America show as much solicitude for the health of employees. Although our conditions are more favorable, they can be improved.

In one thing the Transvaal is far and away ahead of America, and that is mining law. As a matter of fact there has never been a mining district where law in general has been better observed, than on the Rand. At one time law in the 'wild West' was unknown, and even today are found mining centres where the only use made of the laws appears to be to break them. On entering the fine offices of several large mining corporations of this country, I was struck by a conspicuous sign with the ominous words, 'Legal Department'. The mining industry in America keeps alive a lot of 'mining lawyers' who could not live under the simple clear law of the Transvaal. A special line of mining engineering here is the giving of expert evidence and advice in legal fights between contending parties, and the man of persuasive eloquence and immense assurance has a wonderful knack of inducing a judge and jury to swallow a lot of "geological delirium tremens" (to use an expression of T. A. Rickard's). The fear of some outside persons or corporations trying to prove under the law of extra-lateral rights that your mine really belongs to them is a nightmare. To prove to judge and jury that the mine really belongs to you, becomes at times a more difficult problem than the running of the mine. The American law is unfortunate, but it was from our sad experience that the Transvaal was able to devise her superior mining laws. The 'law of vertical planes' in the ownership of claims in the Transvaal, does away with all rows over extra-lateral rights. The mining law there is in many respects so clear and simple that the chances for law-suits are small. Therefore the expert legal mining advisor, as we know him in America, is there unknown. Many engineers have declared that the Transvaal Government is too paternal; that it tries to tell you in too great detail how to prevent accidents. I have studied both systems—that in which the mines are run with scarcely any governmental interference, and those in which there is probably too much, and I must say I prefer the mining regulations of the Transvaal to the lax methods seen in some of our States. Given a competent conscientious manager, and the safety of the men will be guarded, even though it cost a lot of money. But the strict regulations of the Transvaal soon reveal the man who will not look after the safety of his men. The high accident-rate on the Rand is generally adduced to prove the futility of the regulations, but it must be remembered that the labor used is ignorant and stupid. Were the mining regulations of the Transvaal less thorough than they are, and the common American system of *laissez faire* adopted in the Transvaal, the death-rate from accidents would easily be twice what it is today, on account of using so many negroes.

I have been struck by the general spirit of lawlessness apparent in many of the mining districts of the United States. The more settled sections, like the Lake Superior region, are as law-abiding as any other mining centre of the world, but in other parts the laws seem utterly disregarded. For instance, Sunday closing laws for bar-rooms are passed, but the bars disregard them and throw their doors open as wide as ever. In the Transvaal a law is not a dead letter. Any gentleman who does not see his way clear to obey it can either go to jail and live at the Government's expense, or pay a fine. The carrying of concealed weapons is by no means as common there as in America. A person must get a license to have a fire-arm in his possession. In this way the number of revolvers in the community is kept down, and in consequence the 'shooting scrapes', which are such a feature of many American mining camps, are uncommon. The promiscuous sale of fire-arms in America is unfortunate, and I believe the Transvaal system of registration (if carried out) would reduce the number of murders committed.

A new word has become common in American min-

ing during the last ten years, namely 'high-grader'. In Africa during the war they brought in a word for the same offense, namely 'commandeer'. These are polite words for thief. The man who steals gold from a company has a far harder time of it in the Transvaal than in America. In some places many miners seem to think that to steal specimen-rock from underground is no offense, but for a man in the mill or cyanide works to steal gold is reprehensible. The precious metal, it would appear, does not really belong to the company until it gets into the mill-bins. In many districts it seems difficult to get a conviction against a 'high-grader', even when the offense is proved, because the jury is afraid of losing trade in the community in case they convict the thief. How to stop 'high-grading' at many American mines is a problem that greatly worries the management. Much is being done to reduce the evil, but more can be done by the co-operation of all the mines in one district in adopting rigid rules. It should be impossible, for instance, for a known 'high-grader' to get work again in the district where he had committed such an offense.



On the Rand.

Precautions are taken by the management of gold mines where specimens of 'visible gold' are common, to prevent 'high-grading', but it goes on to a large extent. On account of the scarcity of 'visible gold' in large quantities on the Rand, 'high-grading' is practically unknown. But I insist that the law in the Transvaal against stealing is more certain than in America. In the Transvaal the leakage of the precious metal is from the mill and cyanide works, not from the mine.

What a wonderful country America is for its metallurgy! There is no more impressive industrial sight in the world than the great copper smelter at Anaconda, Montana. One is struck by the extensive use of labor-saving devices at this great plant. As there is practically no metallurgical work in South Africa save that in the extraction of gold, few comparisons can be made between the two countries in this regard, but a pertinent one may be made between the cyanide practice of the Rand and of the United States. The Transvaal is justly proud of its work in the cyanide process. This is the Rand's great contribution to the metallurgy of the world. A visitor from South Africa naturally goes to a plant like that at the Homestake, South Dakota, expecting to find a blind imitation of South African cyanide practice, which he naturally considers the best. But he discovers that South Africa has not been followed blindly. Conditions at the Homestake are different from those in Africa, and they have worked out their metallurgical problem with skill and success. I do not remember anything finer in my trip through the States than the metallurgical work at the Homestake mine. I was struck by the fact that the ore there is not as simple a cyanide proposition as on the Rand. Homestake practice differs in many respects, among which are the treating of the sand in the same vat in which it is filled from the battery; the prolonged use of compressed air to aerate the sand and slime, a large compressor being necesary for this; the use of zinc-dust and filter-press for precipitation of the gold-solution as opposed to the use of zinc-shaving and boxes on the Rand; the use of Merrill presses in the treatment of slime as opposed to the decantation process of the Rand; the discharge of sand and slime by water-sluicing, in contrast to the Kaffir and shovel method on the Rand.

The good work being done for American mining by the mining schools is also manifest. Much of the

recent advance is due to these. Were I inclined to criticize, I would say that there are too many schools of mines in the United States. A thoroughly equipped mining college costs a mint of money, and every one of the schools could do better had they more ample funds. These schools have raised, and are raising, the tone of mining. Not many college graduates will be found among the blackguard 'wild-cats', and thieves—those camp-followers that infest the mining army all over the world. Technical graduates generally 'make good'. While on the subject of mining education, I think it no more than fair to mention the good work that correspondence schools, especially the Scranton school, have done for the earnest young men of this country who are compelled to work in the mines, but who nevertheless have a desire to know the scientific principles upon which mining is built. Many a young fellow in America and in the Transvaal has been able to improve his position through knowledge thus acquired. In spite of the good work the mining schools have done and are doing, there are some old 'hay seeds' who say, "Give me a practical man every time; one who started in the business when he was a boy." Even in this enlightened age many people think that anyone can run a mine; that, like poetry, the running of a mine is a gift. They do not seem to realize that a successful dentist, for instance, is not the man to superintend a mine. He might be a good tooth-carpenter, but that does not make him a mining engineer. In my tour I saw some awful mistakes made by these 'practical' men, the dentists, lawyers, physicians, and ministers of mining. One instance especially comes to mind. It was a case of a really good gold-prospect, which I believe will some day become a successful mine. The man in charge is a cowboy by profession. His preparation for his present job consisted in passing the smoke-stacks of a mine for a number of months. He calls himself a 'practical' man. No 'theory' for him, or the men who hold the prospect. Somehow or other he was sent into the wilds to manage this property, and already has almost closed it down. One of his most brilliant feats is the driving of an adit 1100 ft. long through hard rock to get 'backs' only 100 ft. The adit is about 10 ft. below the level of the mill, and all the ore which comes from the opening must be shoveled up-hill. After such examples as this, one is inclined to believe in the Transvaal scheme of making it compulsory for a mine to have a 'certificated manager'. The complete failure of a good mine by bad management might doom a whole district to undeserved idleness.

It will, I am sure, interest American readers to know that the Transvaal has made a splendid start in the important work of technical education, and that there is a mining school at Johannesburg where the young men of the Transvaal can get a mining education before they begin their life work. In connection with this technical college there is an excellent system of night-schools, where the miners and apprentices may learn something of the theory of their work.

There is one department of the Government service to which American mining owes an inestimable debt of gratitude, and that is the Geological Survey. What a help the professional papers on the different districts are to the stranger, when he arrives in a new mining centre and wishes to gain accurate information about the geological conditions! There is no finer government institution in the world, nor one from which greater good has been derived by the State, than the United States Geological Survey. The Geological Survey in the Transvaal has rendered good service, but there remains a great deal more to be done. If it does its work as thoroughly and successfully as the Survey in this country, mining in the Transvaal will be enormously benefited.

In conclusion I wish to comment upon the kind reception and hospitality shown me at every place I visited. The idea prevails that secrecy is the common policy at the American mines, but I must say that my experience does not bear this out. I was taken over mines and works with as much freedom as is always shown the visitor to the mines of the Rand.

MONEY FOR THE GEOLOGICAL SURVEY.

The work of the United States Geological Survey is carried on by means of appropriations made each year by Congress, chiefly in the act providing for "sundry civil expenses of the Government," popularly known as the sundry civil act. The sundry civil act passed by the Congress which has just adjourned appropriated for the Survey for the fiscal year 1909-10 the sum of $1,407,390, specifying that it be applied to the following purposes:

Geologic surveys	$ 225,000
Chemical and physical researches	20,000
Mineral resources report	75,000
Topographic surveys	350,000
Forest reserve topographic surveys	75,000
Water resources investigations	100,000
Structural materials investigations	100,000
Fuel testing investigations	100,000
Mine accident investigations	150,000
Geologic maps (printing and engraving)	100,000
Preparing illustrations for reports	18,280
Books for library	2,000
Statutory and temporary salaries	88,760
Mine inspectors' expenses	3,350
	$1,407,390

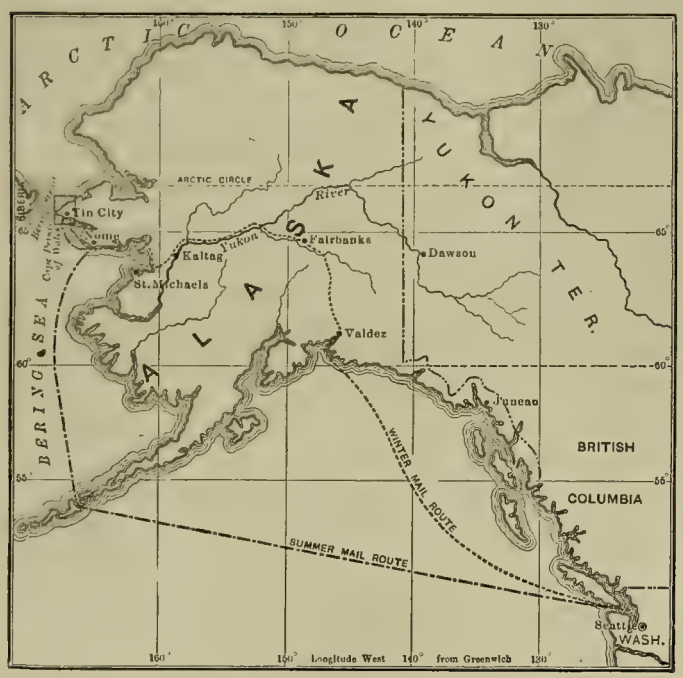
An appropriation of $90,000 for the investigation of Alaskan mineral resources by the Geological Survey was carried in the urgent deficiency act. Other appropriations for rent of offices in Washington and for publications make the total amount provided for the work of the Survey about $1,700,000.

Invar is the name of a new alloy brought out in France, which has the valuable property of having practically no expansion; it is not magnetic, and does not rust. Nickel-steel is the base of the alloy, and up to 20% of nickel the expansion is about normal. It then increases up to 24%, reaching a minimum at 36% nickel, then rising and taking the normal expansion for a 50% alloy. It is the 36% metal which has the desirable property of having the expansion reduced almost to zero, being 17 times less than that of steel, and about the same as for melted quartz.

TRANSPORTATION FACILITIES IN ALASKA AND THE YUKON.

Written for the MINING AND SCIENTIFIC PRESS
By W. M. BREWER.

Notwithstanding that the first great rush into these territories commenced in 1897, but little is known to the outside world of the means of transportation which have been developed. To reach any port along the Alaskan coast, there are five regular lines of steamships controlled by the Pacific Coast S. S. Co., Alaska Steamship Co., Alaska Coast Co., Shubacker & Hamilton, and the Canadian Pacific Railway. All of these, with the exception of the last named, have their home port at Seattle, while the C. P. R. conducts its coastwise service from Victoria as a base. Through connections in Seattle, however, it is enabled to carry passengers to and from that port by breaking the voyage in either direction at Vancouver or Victoria. The ports of entry along the Alaskan coast to which regular steamship service has access are as follows, from southeast to northwest: Ketchikan, Wrangell, Petersburg, Juneau, Haines (for Ft. Seward), Skagway, Sitka, Yakutat, Katalla, Cordova, Orca, Ellamar, Valdez (also Ft. Liscum), Latouche, Seward (Resurrection Bay), Seldovia (Cook's Inlet), Kadiak, Dutch Harbor, St. Michael, and Nome. In addition, there are a large number of ports at canneries and mining camps, served by small vessels that make their headquarters at Ketchikan, Juneau, Valdez, Seward, St. Michael, and Nome. As a matter of fact, at the present time, the service rendered by steamship companies and individual owners of vessels in the various mosquito fleets, is excellent for all needs of travel to Alaskan ports. Of course, the service has not attained such perfection as to place it beyond criticism, but one may visit any point today along the Alaskan coast and feel confident of comfort and safety.



Map of Alaska.

The following table of distances between ports on the southerly portion of the Alaskan coast will serve to show the extent of the coast-line, and when it is considered that in this table only a portion of the coast-line is taken into consideration, and that the Aleutian archipelago, Bering Sea, and the Arctic Ocean coast-lines are much greater, the vast extent of this western possession of the United States may be realized.

TABLE OF DISTANCES.

Port.	Miles.
Seattle to Juneau	899
Juneau to Sitka	160
Sitka to Yakutat	229
Yakutat to Katalla	175
Katalla to Orca	114
Orca to Cordova	3
Cordova to Ellamar	51
Ellamar to Fort Liscum	22
Fort Liscum to Valdez	3
Valdez to Latouche	88
Latouche to Seward	58
Seward to Seldovia	147
Seldovia to Kadiak	117
	2,066

Alaska and the Yukon are often confounded. The whole vast empire lying to the north of British Columbia is frequently thought of as Alaska, not giving the Canadian and the United States Government credit for the territories belonging to them. For instance, notes from Dawson are included under the head of Alaska, when, as a matter of fact, the boundary line between British and United States territory north and south crosses from Mt. St. Elias, Lat. 60°, Long. W. 141°, thence bearing northerly, crossing the Yukon river at Eagle, about 60 miles west from Dawson, thence on to the Arctic Ocean at Demarcation Point in Beaufort Sea. Between the Portland Canal and Mt. St. Elias the portion actually belonging to the United States is represented by a narrow strip 30 miles wide back from the coast-line. Owing to these geographical conditions, it is almost impossible to discuss questions of transportation without considering the two territories and the conditions in both.

The first attempt at railroad-building in this portion of the world was made in 1898 when a company of capitalists began the construction of what is known as the 'White Pass Route,' from Skagway, at the head of Lynn Canal, into the interior. It is not necessary to refer to the difficulties attending the construction of this line from Skagway in Alaska, to White Horse, in the Yukon Territory, a distance of 112 miles. It is sufficient to say that it was looked upon at the time as a costly undertaking, and while it presented no complicated engineering feat, yet it is a monument to the determination, energy, and courage of its incorporators. Railroad construction from the coast into the interior can only be success-

fully carried out from certain ports and through certain passes in the coast range. These are Skagway, Haines, Katalla, Cordova Bay, Valdez, and Seward. The reason for this limited access to the interior is due to the obstacles presented by the coast range, either because of extensive glaciers or of precipitous mountains with passes at high elevations too near to the coast to afford the engineers an opportunity to locate lines with moderate grades.

Up to this time only four of these ports have been actually utilized as terminals for railroad lines, namely, Skagway, for the White Pass route; Katalla, for the lines of railroad into the Bering Lake coal-fields; Cordova, for the Copper River & Northwestern; and Seward, for the Alaska Central. From the port of Valdez attempts have been made that could hardly be called serious. The only other gateway into the interior likely to become the point of departure for a railroad is Haines Mission on Lynn Canal. From this point railroad construction following generally the route of the old Dalton trail up the Porcupine river and thence northerly, could be satisfactorily carried on and would be the means of opening up a large unexplored territory. It would afford an opportunity to open up with little effort the known copper-bearing regions of Rainy Hollow, about 40 miles from Haines Mission, and around the head of the White river, about 300 miles farther to the northwest. A line of railroad constructed from Haines Mission, following the route suggested, would develop an entirely new country and would afford an excellent opportunity for thorough exploration of the water-sheds of the Porcupine, Alsek, and White rivers in British territory, without interfering with the proposed route of the Copper River & Northwestern railroad, at present being built to open up the copper mining district in what is known as the Copper River country. Neither would it affect the present line of railroad from Skagway to White Horse. The section of country around the head of the White river is most easily approached by way of the stage road built by the Canadian Government about three years ago from White Horse to Kluane lake, thence by trail into the White River district.

Until after the boundary line was formally established, it was supposed that the copper prospects discovered at the head of the White river were in American territory, but they are now known to be on British soil.

The following is a list of the mileage and terminals of Alaska railways up to January 1, 1909:

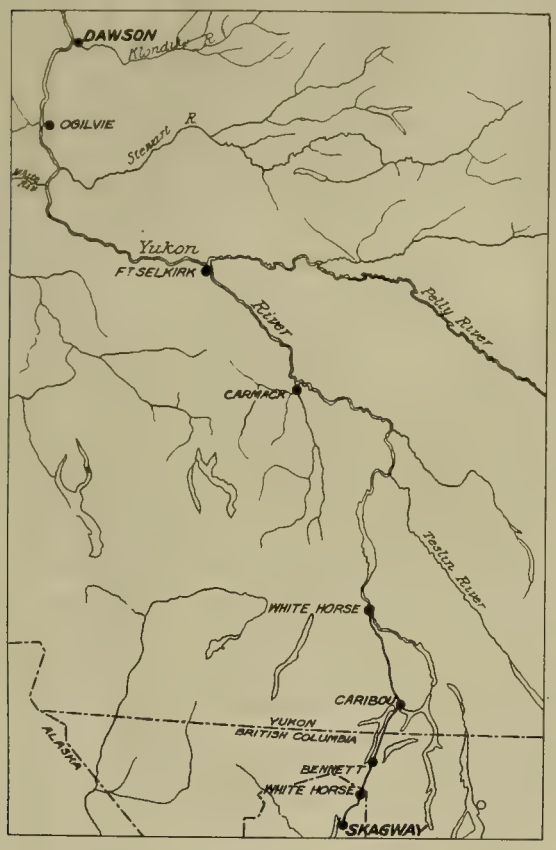
Seward Peninsula.	Miles.
Seward Peninsula Railway, Nome to Shelton...	80
Paystreak to branch S. P. Railway.....	6.5
Council City & Solomon River Railroad, Council to Penelope Creek	32.5
Wild Goose Railway, Council to Ophir Creek...	5
Fairbanks.	
Tanana Valley Railroad, Fairbanks and Chena to Chatanika	46
Kenai Peninsula.	
Alaska Central Railroad, Seward to near head of Turnagain Arm	53
Copper River.	
Copper River Railroad, Cordova to Childs Glacier (September 17)	47
(Probably 11 miles have been built since September 17. Same railroad at Katalla, where there has been some work done by a rival company, has built between three and four miles. At Valdez a few miles of track of the Alaska Home railway were laid in 1907.)	
White Pass.	
White Pass & Yukon Railroad, Skagway to White Horse	20.4
(Terminal at White Horse, Yukon Territory.)	
Yakutat Bay.	
Yakutat Southern Railway, Yakutat to Situk River	9
(Portions of the Council City and Solomon River and of the Alaska Central are out of repair and not in use.)	

The greatest interest in railroad building centres around the Copper River & Northwestern railroad with its terminus at Cordova. This is being built by contract by M. J. Heney, who constructed the White Pass road, while E. C. Hawkins, who was the first general manager of the White Pass road, is general manager. These facts are sufficient to insure rapid progress, and unless unforeseen accidents should occur there is no question that this railroad will be completed to the mouth of the Chitina river by the fall of 1909. During the present season these gentlemen have announced that the railroad will be opened to the head of Abercrombie rapids where connection will be made with steamers that will navigate the Copper and Chitina rivers as far as the mouth of the Nizina.

The section of country known as the Copper River country, which includes the Kotsina, Kushkilina, Lakina, Nizina, all of which head in the range of mountains of which Wrangell and Blackburn are the highest peaks, has, for the past ten years, been one of the most attractive to the prospectors who were looking for copper-bearing ore. Their attention was first called to it by the occurrence of masses and nuggets of native copper which were found by prospectors exploring for placer gold. But it has been difficult of access. Heretofore, exploration was attended by great hardships, as well as excessive cost for freighting supplies in from Valdez. This necessarily retarded progress, but with reasonable transportation facilities a considerable tonnage of copper should be shipped within the next two years.

The railroads projected from Katalla to the coal-fields around Bering lake have had practically no work done on them since the fall of 1907. Although this is the natural outlet from those coal-fields it is on the coast with an open roadstead, which could be made into a harbor only by the construction of break-waters at an expense of millions. For this reason, it is generally understood that a branch of the Copper River & Northwestern railroad will be built from the crossing of the Copper river down the east side, thence easterly to the coal-fields, and that the product will be hauled that way to Cordova. The development of this coal-bearing area will undoubtedly have a material influence upon the future of that portion of Alaska, because, if as is contended, these coal-fields contain good

coking coal, it will be feasible to erect smelters in the vicinity of Cordova and treat the ores produced from that region at home instead of shipping to the smelter at Ladysmith on Vancouver island or at Tacoma. During 1905 the interest in railroad building in Alaska centred almost entirely in the operations of the Alaska Central, then being constructed from Seward on Resurrection bay, across the Kenai peninsula and up the Susitana river, with its proposed northern terminus near Fairbanks on the Tanana river, but financial difficulties and litigation have since then caused a suspension of active construction, and the terminus is about 55 miles from Seward. This road, if continued, will tap the coal-



Part of the Yukon Territory, Canada.

fields on and near the Matanuska river, where it is claimed a quality of coal occurs in quantity which is as good as that developed around Bering lake.

Until railroad construction has progressed sufficiently to bring these coal-fields and the known copper-bearing area in the Copper River district to market, this interior must necessarily remain dormant, except so far as gold-placer mining operations are concerned. Therefore, it is undoubtedly important that encouragement should be given to the construction of at least three main lines of railroad from the coast into the interior, from Haines into the British Yukon, from Cordova to the Copper River, and Bering Lake coal-fields, and from Seward into the Matanuska coal-fields and the territory drained by the Susitna river.

So far as wagon-roads are concerned, the Government of the British Yukon has been enabled, because of its policy and method of producing revenue, to construct a much greater mileage, and much better roads, than are seen in the United States territory, but if the proposed policy of the Road Commission in Alaska is adopted by Congress and sufficient appropriations made, there should be within the near future a main trunk road from the coast through to Nome, which will enable prospectors to transport supplies at a reasonable cost and maintain camps on various rivers and streams from which they can branch into parts of the country that today are unexplored.

Monel metal consists primarily of three parts of nickel to one of copper, this being the natural proportion in which these metals exist in the deposits of nickel ore in the Sudbury district, Canada. Throughout its manufacture the alloy acts as a single metal, and while proof is incomplete, evidence shows that in these proportions nickel and copper have a relation to each other known as eutectic. Like steel, this alloy absorbs carbon, and its physical properties are profoundly influenced not only by the percentages of carbon, silicon, etc., but by the heat-treatment it receives. A standard analysis of monel metal is:

	Per cent.
Nickel	68 to 72
Iron	0.5 to 1.5
Sulphur	0.014
Carbon	0.073 to 0.15
Copper to balance.	

The metal is silver white; takes a brilliant finish; in rolled sheets on being heated it becomes coated with oxide which is resistant to acids, no loss of weight being shown after 40 days service in pumping 40% sulphuric acid; it melts at 1350° C., can be rolled between 900 and 1200° C., can be finished hard or soft like sheet-copper, and can be drawn into wire, soft and pliable, 0.004 in. diam., making excellent material for filter cloths. Its tensile strength is as high as 9000 lb. per square inch.

Electrolytic detinning of scrap iron by a process invented by Meredith Leitch is done as follows: A caustic soda solution is withdrawn by means of a pump from the detinning bath at a point near the bottom, where it is coolest; it is forced through a boiler, where it is heated; and returned to the detinning bath at a point near the top, but below the surface of the electrolyte. The advantage over an overflow arrangement is that with this method of circulation the caustic soda does not come in contact with air, which would result in the formation of a carbonate. A second device consists of a U-shaped basket with perforated walls, having in its interior a conveyor-chain carrying tin-scrap through the cell. On both sides of the basket are cathode plates. The whole is contained in a tank filled with electrolyte. The tank is lowered at certain intervals, the electrolyte run off, the tin powder removed from the cathode plates by scrapers, and the apparatus cleaned.

In dies and die-blocks an iron-titanium alloy gives tremendous resistance to shock and consequent large increase in the life of such castings.

CYANIDATION OF PARRAL SILVER ORES.

By H. T. Willis.

*One of the pioneer mines in the application of cyanidation to silver-gold ores was the Creston-Colorada mine of Minas Prietas, Sonora, Mexico. Until then the extraction of the silver-content of ores was simply incidental to the recovery of the gold. The Creston-Colorada installed a 125-ton plant for the treatment of sand from the concentration mill, which had succeeded the earlier pan-amalgamation plant. Good results followed the cyanidation of the sand tailing by applying gold extraction methods and by increasing the period of treatment to about 15 days, but at that time they had no way of treating the slime, which they therefore impounded in storage dams.

Other mines in Mexico followed the example set by the Creston-Colorada, with varying results, and from that time cyanidation of silver ores commenced. South African and West Australian practice was then in the forefront and their methods have since been applied, with modification, to the treatment of Mexican silver ores. Mexico has always been, and is today, the only country where silver ores have been treated to any considerable extent, and it is there that the cyanidation of silver ores has been developed to its present high state of perfection.

In 1904 the Creston-Colorada Co. remodeled the entire plant and installed a slime plant of 100 tons capacity. The capacity of the mill and cyanide equipment was then 200 tons per day, and it was the most modern and complete in Mexico as well as one of the best of its kind in the world. It is today one of the best in Mexico. The fact was demonstrated that, with modern methods and equipment, silver could be treated as successfully as gold ore.

The practice at the Creston-Colorada plant during my connection with it, up to May 1905, was briefly as follows: (1) the ores were crushed in Blake crushers; (2) reduction by stamps in cyanide solution; (3) re-grinding to 60-mesh by Huntington mills; (4) hydraulic classification of sand and slime; (5) leaching of sand for 15 days with cyanide solution of various strengths; (6) slime agitated 18 hr. with strong cyanide solution; (7) slime residue filter-pressed; (8) all solutions precipitated on zinc; (9) precipitate filter-pressed, dried, and melted into bullion.

The value of the ore treated was 13 oz. silver and 0.75 oz. gold. It was considered exceptionally refractory material, but the extraction averaged about 87%. Since 1904 the improvements in the cyanidation of silver ores have been chiefly along the line of making and filter-pressing slime, for it has come to be understood that in order to secure the best extraction from silver ores they must be reduced to a slime and thoroughly agitated, thus requiring filter-presses to separate the precious metal-bearing solutions economically. The most modern practice is to reduce the ore to a slime at once.

The first plant in Mexico to reduce all the ore to slime was at the Dolores mine, in the State of Chihuahua, in 1906. Under my direction, the results obtained exceeded the most sanguine expectations. The ore was worth about $50 per ton, and the extraction was about 95% of the silver and 97% of the gold. These were averages for long periods. That the treatment of silver ores is of vital importance to Mexico may be readily understood from statistics which show that Mexico produces more silver than any other country in the world.

During the year 1907 Mexico's silver production was valued at $43,814,896, as against $38,445,236 for the United States. Mexico's production of gold for the same year was only $17,820,000, and of copper, 61,127 metric tons, which, at 20.661c. per pound, the average price for the year, is $27,842,884.

As in the case of gold ores, cyanide in the treatment of silver ores is not of universal applicability, but it is safe to say that fully 90% of all the silver ores in the country, not suitable for smelting, are adapted to sucecssful treatment by this process. In order to give some idea of the number of silver cyaniding plants in Mexico, the following partial list is submitted:

Name.	District.	State.	Capacity, tons per day.
Dolores	Temósochic	Chihuahua	100
Concheño	Ocampo	Chihuahua	150
Palmarejo & Mex	Chinípas	Chihuahua	200
Pinos Altos	Pinos Altos	Chihuahua	200
Candelaria Consolidated	San Dímas	Durango	30
Siánori M. & M.	Siánori	Durango	20
Mex. Con. M. & S. Co.	Guanaceví	Durango	150
Guanajuato Con.	Guanajuato	Guanajuato	250
Guanajuato Red. & Mines	Guanajuato	Guanajuato	250
Guanajuato Amalg.	Guanajuato	Guanajuato	300
San Próspero	Guanajuato	Guanajuato	100
El Cubo	El Cubo	Guanajuato	50
Peregrina	Guanajuato	Guanajuato	250
Pinguico	Guanajuato	Guanajuato	250
Cia. Beneficiadora	Pachuca	Hidalgo	100
U. S. Mining	Real del Monte	Hidalgo	250
U. S. Mining	Pachuca	Hidalgo	250
San Rafael	Pachuca	Hidalgo	120
La Union	Pachuca	Hidalgo	125
Pachuca Tailing	Pachuca	Hidalgo	150
Amparo	Etzatlán	Jalisco	240
San Rafael	Ameca	Jalisco	25
Las Dos Estrellas	Tlalpujahua	Michoacan	625
Palmarito	Culiacán	Sinaloa	200
Creston-Colorada	Minas Prietas	Sonora	200
Red Mountain	Santa Ana	Sonora	200
Alma	Vievas	Zacatecas	60
El Bote	Zacatecas	Zacatecas	150
San Rafael	Zacatecas	Zacatecas	100
San Cristóbal	Zacatecas	Zacatecas	80

The total capacity of the above list amounts to 5165 tons per day, and constitutes only a portion of the silver cyanide mills of the country.

The different classes of Parral ores adapted to this treatment may be divided as follows: (A) clean silicious silver ores amenable to direct cyanidation, yielding pure silver bullion; (B) silicious silver ores containing a small amount of sulphide, amenable to concentration followed by cyanidation; (C) base sulphide ores requiring concentration and cyanidation of the tailing. Extractions of 80 to 95% can be obtained from these ores, depending upon their character and value, but all could be treated

*Abstracted from the *Parral Miner*.

at a profit under favorable conditions. I do not mean to say that all grades of ore can be treated profitably, for that is a function of the sort of treatment, which in turn is dependent largely upon the cost of power. The cyanide process has been employed so long for the treatment of tailing and low-grade ore that it has come to be accepted generally that the process is applicable only to the treatment of low-grade material. Such a condition is unjustified by statistics. For example, if an ore assaying 500 gm. silver yields 85% extraction and the tailing assays 75 gm., then it has been found that the same class of ore, with the same mineralogical content but assaying 1000 gm. silver will yield, say, 90% extraction and the tailing assays about 100 gm. In other words, the percentage of extraction obtained from any given ore is not constant, but is dependent largely upon the grade of ore treated, and the value of the tailing after treatment will be more nearly constant than the percentage of extraction. In the same way, 1500-gm. ore might be expected to yield 95% extraction.

It may be of interest to estimate the cost of treating Parral ores. The most modern plant would be about as follows: (1) Gates coarse rock-breaker to 2½-in. size; (2) Gates fine rock-breaker to 1-in. size; (3) heavy stamps (1500 lb.), 18-mesh screens or coarser, for class A ore, crushing in cyanide, weak solution, low discharge; (4) Wilfley concentrators (for class B); (5) Wheeler type grinding-pans (60-mesh); (6) tube-mills for sliming to 200-mesh; (7) air-lift agitation tanks of Pachuca type; (8) Ridgway or Butters slime filter-presses; (9) zinc precipitation, oil-burning tilting furnaces, clean-up presses, etc. Such a plant would cost, erected complete and equipped with electric motors, from $10,000 per ton for a plant of small capacity to $500 per ton for one of large capacity, of say 500 tons per day.

It is difficult to estimate cost of treatment without actual data upon the particular ore to be treated, and of course the ore of any particular mine should be tested separately, as each one will be different from every other and require slightly different treatment and equipment to obtain the best results.

As an example of what might be expected, assume that a large mine is supplying 500 tons per day to the mill; that the water was supplied by the mine and charged to mining expenses; and that power was available at 1 cent per hp-hr.; then the cost per ton of ore might be about as follows:

Cyanide, 1.5 kilos, at 34c.	$0.5100
Zinc, ¾ kilo, at 20c.	0.1500
Lime, 6 kilos, at 0.275c.	0.0145
Power, 1.75 hp., at 24 hp.-day	0.4200
Steel, pebbles, iron, etc.	0.1600
Lubricants, lamps, etc.	0.0125
Melting bullion and supplies	0.0500
Foreign salaries and labor	0.1380
Native salaries and labor	0.1045
One-half general manager's salary, at $10,000 per year	0.0280
One-half general office expenses	0.0200
Sundries	0.0050
Total charges	$1.6125

In addition to the above cost of treatment must be added the following variable expenses:

	%
Mexican Federal tax, minimum	2.5
State tax	1.5
Additional Federal tax, 20% of 1.5%	0.3
Assaying, transportation, and realizing	1.7
Total variables	6.0

Suppose the above mill were treating ore assaying 500 gm. and obtaining an extraction of 85%, then the total cost would work out as follows:

85% of 500 gm.	425 gm.
425 gm. (Ag. at 55c. per oz.)	$7.5200
6% of $7.52	$0.4512
Cost of treatment	$1.6125
Taxes and realization	0.4512
Total cost	$2.0637
Profit on 500 gm. ore	$5.4600

The cost of mining in the district, under favorable conditions and in the more favorable mines, on a large scale, would probably be about $2.50 per ton, which, reducted from the profit above, would leave $2.96 per ton as the profit on the entire operation of mining and milling ores of the grade assumed above.

The above estimate, although conservative, is based upon favorable conditions which could not be obtained at all mines, and it is probable that with a small plant and less favorable conditions the cost of treatment would, under present conditions, be about $3.50 per ton. All costs and values used are in terms of U. S. currency. Milling costs at various plants may be of interest as showing what is being done at different places under a large range of conditions.

Name.	Place.	Cost per ton.
Dos Estrellas	El Oro, Mexico	$1.80
El Oro Mining Co.	El Oro, Mexico	1.53
Guanajuato Con. Co.	Guanajuato	4.49
Isabella Mill	Cripple Creek, Colorado	0.87
Rand Mines average	South Africa	1.33
Ivanhoe Gold Co.	Kalgoorlie, Australia	2.20
Oroya-Brownhill	Kalgoorlie, Australia	3.30
Associated Northern	Kalgoorlie, Australia	2.85
Associated	Kalgoorlie, Australia	2.76
Great Boulder	Kalgoorlie, Australia	2.66
South Kalgoorlie	Kalgoorlie, Australia	2.65
Gt. Boulder Proprietary	Kalgoorlie, Australia	2.48

The custom rates on Cripple Creek ores at Golden Cycle mill for various grades of ores are:

Class of ore.	Freight to mill.	Treatment charge.
Up to $ 8	$0.75	$3.25
$ 8 to 10	1.00	3.50
10 to 15	1.00	4.25
15 to 20	1.00	5.00
20 to 25	1.25	5.25
25 to 30	1.25	5.75

It would therefore appear that with cheap power and local milling facilities, with the large quantities of good ore available, approximately 500 gm. silver, Parral should become prosperous and her brilliant past be succeeded by a still more brilliant future.

The area of a circle is equal to the area of a triangle whose base equals the circumference and the perpendicular equals the radius.

PROTECTION OF MEXICAN INVESTORS.

Written for the MINING AND SCIENTIFIC PRESS
By F. J. H. MERRILL.

In discussing the protection of investors in mines and mining securities we are brought face to face with the fact that there are many dangers outside of errors in technical management, or misrepresentations as to ore reserves and possible or probable profits.

The large amount of American and English capital sent into Mexico, gives importance to the consideration of possible dangers which may accrue to investments in Mexican mines through ignorance of the laws relating to mining titles, their ownership and their transfers. The Mexican mining code is simple, and in many ways preferable to the corresponding laws in the United States, especially in limiting all sides of a mining claim by vertical planes. Furthermore the possibility of legal complications affecting the ownership and transfer of mining properties in Mexico is no greater than in the United States. The main dangers arise from the lack of penalties for the violation of its provisions, and from ignorance or neglect of other codes affecting the tenure and transfer of property. Dangers may also arise from incompleteness of the indexes and the lack of publicity in the records of the mining offices and the offices of public registry for transfers of real estate and encumbrances.

A mining title in Mexico is essentially real estate, except that its permanency depends on the payment to the Government of an annual rental or *impuesto* of six pesos or $3, for each pertenencia or unit of 100 metres square. This rental is payable in three installments due respectively on the first day of March, July, and November. If the tax is not paid within one month of the time when it falls due, a penalty of 50% is added; if not paid during the second month 100% penalty is added; if not paid during the third month the property may at once be declared forfeited, and is then open to re-denouncement, that is, to re-location. Where the delay in payment is due to unavoidable causes, such as litigation, a petition to the treasury department, setting forth the reasons for the delinquency, may result in an extension of time for paying the tax, or a remission of part of the penalty.

The titles to mining as issued by the Government, purport to be absolute, but really depend for their safety on the accuracy of the surveys and the care with which they are tied to fixed points which may be readily identified, as well as on the fact that no prior denouncement has been made on the same ground. This is wholly the risk of the investor, for, if it happens that a denouncement be made, and through the carelessness or incompetency of a surveyor the survey be not accurately tied to fixed points, or if these points be not accurately described, a second denouncement may be laid over the first and a separate title observed, and the latter, if more carefully located with reference to the tie-points, may displace the first denouncement. Occupation may be of no importance in establishing title, on which the original application was based has been so made that the bearings taken to points of reference are indecisive in case of a law-suit. These conditions may be better understood when it is stated that sometimes the only points of reference are mountain peaks several miles away. In such cases it is obvious that, with poorly adjusted instruments or careless reading, the exact position of the starting point of a survey may be indeterminate within two or three hundred feet.

On ground where other claims have long been established, and where a new denouncement adjoins older ones which are well monumented and have long remained in undisputed existence, the problem is simpler. But sometimes, a new denouncement is made over an old one which has laid unmonumented and forgotten by all but its owner, who has kept the taxes paid, and after some money has been spent by the owner of the later title, the proprietor of the original one arises to assert his ownership.

The Mexican mining code provides for the placing of monuments of substantial and permanent character, but there is no penalty fixed for neglect to obey this provision. Consequently instances have occurred where a careless or malicious person has taken up a claim and left it unmonumented. Subsequently a second person has innocently located another claim on virtually the same ground, only to find, after going to considerable outlay that he has been spending money on another man's property. Under such circumstances the Government has held that the original owner who left his claim unmonumented should pay all expenses of the second denouncement. This, however, might be no adequate compensation for loss of time and opportunity; moreover, the original owner might be financially irresponsible.

A further danger may arise when mining properties are located on or near the boundaries between districts. The organization of the Mexican Republic into States and Territories is somewhat similar to that in the United States; the districts of the Mexican States corresponding, in a measure, to the counties of our own country. Each county or *distrito* is a unit of administration for the various departments of the Federal Government. There is, therefore, in each district, an *Agencia de Minera* or mining agency, where all applications for mining or denouncements are received and transmitted to the *Secretaria de Fomento* at Mexico City.

The boundaries between some of the States and districts are indefinite, and though their general position is determined by reference to mountain peaks or other natural objects, these points of reference are sometimes twenty miles or more apart, and a mountain peak as a survey monument is a rather broad and vague object, so that the exact position of the line may be determined only by an expensive survey which involves selecting fixed points on the mountain tops. The upshot of this is, that in some States a mineral claim near a district boundary may be located by different persons in each of two adjacent districts, and two separate titles issued in good faith by the President of the Republic, the question

as to which title shall stand, being sometimes a matter of litigation involving a survey of the boundary. Of late, in such disputes, the Court has held that the earlier denouncement shall have precedence, but this does not indemnify the later claimant, who may have acted in good faith. As all the State boundaries are district boundaries, a mineral claim in the vicinity of one not accurately surveyed should be located with extreme caution and it may be advisable to apply to the Court to declare it legally located in a certain district.

Title having been issued on the basis of an accurate survey, and the taxes paid when due, the subject of transfer may arise. This is one of the most serious questions which complicate Mexican mining titles, because many persons undertake to make and receive transfers, without considering the provisions of the Mexican law. First is the matter of the right to convey. Under the Civil Code of Mexico, a wife has a half-interest in all property acquired by her husband during the state of matrimony except that received through inheritance or gift. Consequently, she must join in all conveyances of such property or they are illegal and void. In fact, judgment on a note given by a married man, but not signed by his wife, cannot be satisfied out of his real estate. Many a mining title in Mexico has been jeopardized by a conveyance from a married man, often an American, whose wife is not living with him, and whose existence is not known, but whose legal interest in one-half of the property still remains active. Furthermore, in Mexico, when a married woman dies, her heirs inherit her half interest in the husband's property so, it may be said, that when a man's wife dies, he loses half his fortune.

Under such conditions a widower might make an invalid transfer of a mine because a half interest in the property had passed through his deceased wife to her children. This half-interest of the wife in mining property taken up by the husband during the state of matrimony is often a disturbing element when a married man has been employed by another person or by a company to take up mining titles in the capacity of agent, but without power of attorney or specific legal authority.

Besides the legal questions which may affect the right to convey, are those which affect the right to receive a conveyance. Concerning individuals these only relate to the frontier zone of twenty leagues within which no foreigner can hold real estate without special permission granted for the specific piece of property under consideration. The right to hold real property is somewhat more difficult to obtain for foreign corporations, because they cannot do business or hold property; in other words they have no legal existence, in Mexico, until they have been protocolized. This is a process which involves placing on record with the Department of 'Exterior Relations' at Mexico City, complete copies of the articles of incorporation, by-laws and minutes of the American corporation, accompanied by translations into Spanish made by an official interpreter. These must all be certified by a Mexican Consul. A company thus protocolized becomes in effect a Mexican corporation with all legal powers but, as the Mexican Republic levies a tax on the capital stock of corporations, in order to avoid this expense, another method is frequently resorted to. A Mexican corporation is formed with a nominal capitalization to hold the title to the property and the stock of this Mexican company is held by the American corporation.

It is unfortunately true that many American mining companies have been formed to operate in Mexico which have never put themselves in a position to legally hold property, and the stockholder's money has been obtained, so to speak, under false pretences, because the company has no legal title to the property which it claims to own and undertakes to operate.

Sometimes the Mexican property is held by an officer of the company, but frequently the person holding the title has never been appointed or authorized by the company to act as trustee of its Mexican property, and so the company has no legal control over it. Again we hear of cases where the American and Mexican companies are duly formed and the titles are held by the latter, but the stock of the Mexican company is not transferred to the American company. We also hear of instances where the American and Mexican companies are duly formed, and the stock of the latter transferred to the former, but the title to the mining property is held by some individual who made the denouncement for the company. Theoretically, it would be a simple matter to put all details of title and incorporation in the hands of two good lawyers, one in the United States and one in Mexico, but this is often neglected. While, no doubt, many companies have their business transacted in a thorough manner, many are careless.

The writer is cognizant of a mining corporation formed under the laws of one of the Middle States, and of which the officers are reputable lawyers in an Eastern city, which took up properties in Mexico under the following surprising conditions. The American company was not protocolized and no Mexican company was formed to hold titles. Certain titles were purchased from a married man whose wife did not join in his conveyance and who was subsequently employed to make other denouncements which he in turn conveyed to the company without his wife's consent. These conveyances, which were invalid, were all made directly to the American company, which had no legal existence in Mexico, and therefore could not hold property, and the company leased its supposed holdings to another American corporation, which built a mill on the property and undertook to operate it. To cap the climax of loose business methods, one of the stockholders of the original company obtained a loan on this absolutely worthless stock, from a Mexican bank which was too careless to investigate the condition of the titles and the legal status of the corporation.

As a result of extensive experience with the matters in question, I am confident that, in any future revision of the Mexican mining code, much good

might be accomplished by provisions and penalties, such as I venture to suggest. Loss of property should follow failure to comply with that section of the law relating to the erection of monuments within, say, three months. Punishment by imprisonment should be inflicted upon a surveyor who is instrumental in locating a claim on ground where he has knowledge that a prior denouncement has been made. Greater publicity is needed in the records of the local mineral agencies; more complete indexes and especially indexed district-maps showing the ranch boundaries, on which all claims shall be plotted as soon as the titles are granted, such records to be open to inspection by the public. Further, where a denouncement is made close to an unsurveyed district boundary, the mineral agent should be required to notify the central mining office in Mexico City so that comparison might be made with the records of the adjacent district and thus avoid conflict.

The points above mentioned relating to mining titles, have all been matters of dispute or litigation in the State of Sonora during the past four years.

A leaky hand-hole in the rear end of a boiler, where the plate had been allowed to leak until the head of the boiler had corroded away so that it could not be kept tight, was repaired by a correspondent of the *Engineers' Review* as follows: A steel ring ⅜ in. thick and 1½ in. wide was procured from the boiler-shop and put on. To do this the ring was bored for ½-in. rivets and corresponding holes were drilled in the boiler-head and countersunk on the inside, in order to bring the heads even with the plate and leave a clear place for the packing. The countersinking was done by placing the drill-chuck in a piece of ⅜-in. pipe and running it through the front hand-hole. By fitting the countersink in the chuck and the outer end of the pipe in the ratchet, one man did the turning while the other kept the countersink in the hole, and from running out of centre. When driving the rivets, a cupped piece of pipe was used to hold them in place in the same way, until they were headed. Then by the use of a gasket that did not require 'following', the job was completed satisfactorily.

Titanium has been used in small proportion in some high-speed steels, and to a considerably larger extent it has been used in the manufacture of other steels. It is reported to add greatly to the hardness, tensile strength, and elastic limit of steel, closely resembling vanadium in this respect, though Guillet seems to think its influence unimportant. Information is lacking as to whether or not titanium can be used to replace other hardening elements to any considerable extent. It is so widely distributed and is so cheap compared with the other hardening substances used in high-speed steel, that its exploitation in this direction will be watched with interest. Unlike titanium, the ores of uranium occur but rarely. Some experiments have been carried on to determine the utility of uranium as a high-speed steel alloy; but thus far it has not been shown to add any important qualities which are not obtainable by the use of cheaper elements already much used.

LAW OF MILL-SITES.

Section 2337, U. S. Revised Statutes, provides for two classes of mill-sites, as follows: (1) Where non-mineral land is used by the proprietor of a vein or lode for mining or milling purposes; and (2) where a quartz-mill or reduction-works is situated on non-mineral land and no mine is owned in connection therewith.

The statute is silent as to the manner of locating such mill-site and as to the conditions of its tenure after location. It is well established that, where the mine is abandoned, an unpatented mill-site of the first class will be held to have been also abandoned, for "there can be no mill-site (of the first class) unless there is a lode or vein to which it may attach." There would be no doubt but that the mill-site under discussion would, under the circumstances, be held to have been abandoned if it were of the first class. But since the original owner has erected a quartz-mill on it, there is good reason for holding that, by virtue of the existence of the quartz-mill, it became a mill-site of the second class, and that it is no longer essential that a mine should be owned in connection therewith. The mere abandonment of the mine would not, under such circumstances, result in the abandonment of the mill-site.

Whether a mill-site has been abandoned is a fact the determination of which is dependent upon the particular circumstances. The courts have held that lapse of time does not of itself constitute an abandonment, and is only a circumstance for the jury to consider in determining the question whether there has been an abandonment. The question is one of intent. As already intimated, the statute does not provide the manner of holding a mill-site when once located, but it has been decided that annual labor is not required to be performed on such a location. A reasonable use of the mill-site is all that is required. Just how long an unpatented mill-site might be allowed to remain idle without being forfeited would depend upon the particular circumstances of each case. If a mill-site has actually been abandoned, improvements situated thereon, of the nature of a quartz-mill, being fixtures, and, therefore, becoming a part of the realty, would revert to the government, and would become the property of any subsequent locator, and cannot be removed by the original owner of the mill-site after a valid re-location has been initiated.

The production of primary spelter in this country in 1908 amounted to 210,424 short tons. Compared with the production in 1907 this is a decrease of 39,436 tons, or 15.8%. The domestic consumption of spelter decreased from 228,509 short tons in 1907 to 215,401 tons in 1908—a loss of 5.7%; the production of spelter in the world decreased from 813,842 short tons in 1907 to 799,644 tons in 1908. In 1908 the domestic production was about 26% of the world's production; in 1907 it was about 30 per cent.

A horizontal distance is equal to the sloping distance multiplied by the cosine of the angle of the slope.

PROTECTION OF INVESTORS.

The committee appointed by the Pacific Coast section of the Mining & Metallurgical Society of America to outline the character of the information to be given to shareholders of mining companies, has recommended:

For the full protection of investors every mining company should incorporate in its annual report the following essential items of information:

1. A brief review of the past history of the property, the work accomplished and the results obtained, with tabulated statement of expenditures and receipts from the beginning, marketable products made each year, and the sums received from the sale of same, the annual net earnings and the disposition made of such earnings.

2. A similar review, but in more detail, of the work of the year, with statements of the assets and liabilities (these statements to show all details as to capitalization of the company; the number and classes of shares outstanding at date of the report; the respective rights of these shares; the number of shares remaining in the treasury; any options or contracts on such shares; any bonded indebtedness), receipts and disbursements, cost sheet, and other information as to work accomplished and results obtained.

3. A statement of ore reserves at the date of the report, compared with the reserves of the previous year, with an estimate, by the officers of the company, of the probable life of the mine, and a valuation of the property, accompanied by statement of the data upon which such valuation is based.

The foregoing is practically the resolution adopted by the New York section of the Society, with the following exceptions:

In the second paragraph a parenthesis is inserted to specify details of capitalization, so that an investor may be able to learn the number of outstanding shares entitled to participate in dividends.

In the third paragraph the words "competent authority" have been changed to "officers of the company." This is to make the persons responsible for the operations of the company also responsible for any statements as to probable life and valuation.

ALASKA-YUKON EXPOSITION.

The buildings for this important exposition at Seattle are approaching completion, and there is evidence of wide-spread interest in this Pacific Coast exhibition of natural and manufactured products. The mining exhibit promises to be unusually fine, the display including gold-saving devices of many kinds. The U. S. Geological Survey will establish a model rescue station, illustrating the application of safety devices in coal mines. Alaska will have a splendid array of gold nuggets and copper ores.



Mines Building, Alaska-Yukon-Pacific Exposition, Seattle.

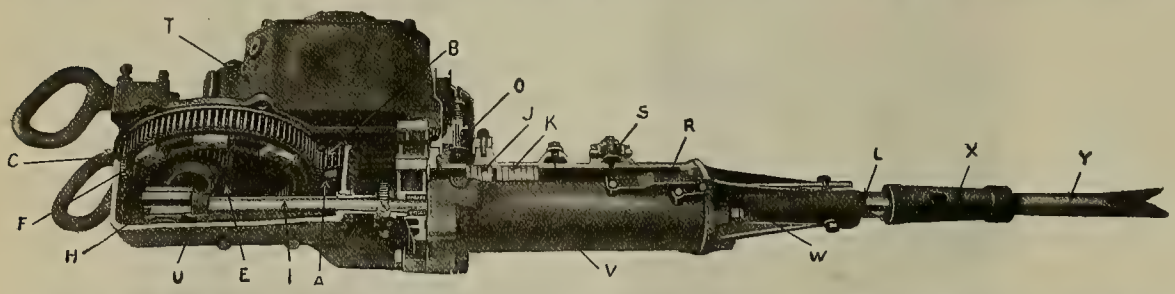
Test for titanium, according to Fenton, may be made with dihydroxymaleic acid in cold dilute aqueous solution, which gives an intense reddish brown solution. V does not give any such coloration. In concentrated solutions the reagent gives a voluminous chocolate-colored precipitate, which acts as an acid, affording bright orange-colored salts, which might be used as an indicator. The compound is destroyed or prevented from forming by HF or fluorides.

Since the conquest of the country by the Spaniards Mexico has been a great producer of silver and, more than any other nation, up to the middle of the last century had influenced the relations of this metal to the affairs of the world. Besides the great shipments of the refined metal which were made to private owners and as contributions to the Crown of Spain, the mints of Mexico coined for domestic use and for shipment to the Far East a grand total of over 3,000,000,000 oz. of silver.

Difficult Air-Cushion Problem.

It was early apparent to those familiar with the varied needs of mining that electricity would eventually play a most important part in the work. But progress was relatively slow, due to the failure of designers of electrical equipment to realize the conditions which they must meet. In the coal mining industry two types of machine have been prevalent, the so-called breast machine, with which the cutting is done by knives or chisels rigidly held on a moving chain, and the puncher machine, in which a pick is given a reciprocating motion, striking successive powerful blows against the coal. The application of the electric motor for driving the chain-machine was comparatively simple, for the rotative motion of the motor readily lent itself to driving the chain through the medium of gears.

But the problem of utilizing a motor to give reciprocating motion to the pick was far more difficult of solution. Evidently, in a percussive tool, the vibrations if transmitted direct would be destructive to the motor. While the problem has been attacked from almost every conceivable point, experience has demonstrated that in order to give sufficient flexibility the blow itself must be struck through the medium of compressed air. Hence in the development of the only successful electrically driven puncher the compressor cylinder has been retained and different means of compressing the air have been devised. In but a single case, that of the 'pneumelectric' coal puncher, was the fundamental



requirement fully realized, namely, that the blow should be struck by air expanding in the same cylinder in which it is compressed. This machine, built by the Pneumelectric Machine Co., Syracuse, N. Y., and illustrated herewith, comprises within the same frame the electric motor and the air cylinder. In its design and construction it displays many novel and ingenious features of interest to the electrician, the engineer, and the mechanic, even more than to the coal miner. The driving motor, which is of the ordinary series-wound four-pole type, possesses no unusual features tending to make it complicated or requiring special generators for supplying current; but is designed along standard lines with reference to the work to be done. This motor, with vertical shaft, is completely enclosed, the motor-frame and gear-case cover being made in one piece of cast-steel. By this means, strength, light weight, and simplicity are secured. Support for the upper or commutator end of the motor-shaft is furnished by a Hess-Bright radial ball-bearing. At the lower end is provided a ball thrust-bearing for taking the weight of the armature, and also a long bronze bushed bearing for taking up the lateral thrust due to the motor-drive.

On account of the necessity of employing an enclosed motor, the matter of ventilation and cooling of the various parts became important. It is accomplished in the following manner. The air to be compressed is drawn in through the armature and field windings at each forward stroke of the air-compressing piston. By this means about 28 cu. ft. of cool air per minute passes over the heated parts at a velocity of about 2½ ft. per second. This has been found effective. It is entirely automatic, requiring no auxiliary appliances.

The insulation on the field coils and armature windings is of the highest insulating and water-resisting quality. The commutator is made of drawn bars of solid copper, mica segments,, and micanite insulation. The armature is drum-wound with formed coils. It is built substantially, and the utmost care has been exercised in obtaining the greatest capacity from the space occupied.

By a novel and simple arrangement of gears the circular motion of the motor is transformed into the straight-line motion of the primary or air-compressing piston in a cylinder at the forward part of the machine. In the same cylinder is a second piston connected with the striking pick, but having no mechanical connection with the first. Under the influence of the air which is compressed by the first piston, and delivered through the open ports controlled by the same piston, the second one is alternately driven backward and forward, but is always prevented by the air-cushion from striking at either end of the stroke. As the maximum amount of power is required only when the air is being compressed during the backward stroke of the motor-driven piston, and during the control of the machine, that required by the electric motor is uniform, regardless of the character of the material in which the machine is working. The piston diameter is 6¼ in. A final pressure of about 80 lb. in the compressing cylinder has been found best for operation. At 220 volts the motor runs at three speeds, giving 170, 155, and 140 strokes per minute. The power taken never exceeds 7½ hp., about ⅓ of that required by other types of machines of equal capacity.

The operation of the machine is as follows: the pinion B on the end of the armature-shaft A, engages with the main driving gear C. Through the medium of the internal gear F, the crank pin E, and the crosshead H, the rotating movement of the armature is changed into the reciprocating motion of the piston rod I, and the piston J. The latter, or rear-piston, which is driven by the motor, compresses air on its backward stroke, the front piston K, with which it has no mechanical connection, follows simultaneously, because of the vacuum produced by the recession of the piston J. Air is coincidently admitted to the front side of piston K, through the port R. On the rear side of the piston J, next to the motor, the air is compressed, and just at the end of the stroke is admitted through large by-passes to the space between the two pistons. As a result the front piston is forced forward by the entire body of compressed air, which is admitted almost instantaneously. The speed is far higher, and the resultant blow is much more powerful, than in the ordinary compressed-air coal-cutter, although the amount of air expanding behind the pneumelectric system is much less. During this stroke, air is drawn into the cylinder behind the piston J, through the main inlet valve O. On its forward stroke the air in front of the driven piston K, escapes through the port R, but after the piston has passed and therefore closed the port, a sufficient amount of air remains to cushion the blow and to prevent damage to the front cylinder-head. This cushion-air may leak somewhat, and to prevent an insufficient supply, which would have the effect of producing a partial vacuum in this space and of holding the front piston on the return stroke, a small inlet valve R, is placed in the forward part of the cylinder to allow air to flow in under these conditions and before the open port is passed. After the front piston K has made its forward stroke the rear piston J follows, mechanically driven as before, and would compress the air which has just made the stroke of the front piston, which then remains between the two pistons, but for the so-called vacuum-valve

S, which allows all air between the pistons above a certain pressure to escape to the atmosphere. The placing and action of this prevent the two piston-faces coming together.

Multi-Current Feed-Water Heater.

It has been demonstrated that to attain the highest efficiency in feed-water heating the steam and the water to be heated must be kept in motion at a considerable and uniform speed, and that the changes in direction of flow shall result in counter currents of steam and water in close contact, and so directed as to compel the greatest transfer of heat possible. Heaters are ordinarily designed with little regard for the right direction and speed of flow. Area of heating surface alone does not determine the capacity of a heater. The essential thing is the proper directing of the moving currents and the speeds at which they shall flow. These conditions are perfectly met in the construction of the Blake-Knowles heater, and tests show clearly high efficiency. The interior of the shell, through which the steam



passes, is divided by longitudinal partitions, in which the water-tubes are so arranged that the steam flows the entire length of the shell, in close contact with these tubes, three times before finally passing out. The water-tubes are securely expanded into the tube-heads, one of which is a part of the main casting, while the other is bolted to a flexible diaphragm, the periphery of which is fastened to the shell flange. This takes care of the tube-expansion and makes unnecessary any troublesome stuffing-boxes for the individual tubes. These water-tubes are of small diameter, so that the heat passes quickly through the water, and six changes in direction of flow give the high water-velocity essential for the best working results. Removal of the heater-heads gives access to the interior, and the tubes are easily cleaned from the top end. These heaters are also made horizontal, and are fitted with saddles in place of feet, as in the case of the vertical type.

They are built in a great variety of sizes covering the range of modern engineering demands. Further information in regard to these heaters may be obtained from The Blake & Knowles Steam Pump Works of New York and Boston.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

MINING METHODS IN EUROPE. By Lucius W. Mayer. 8vo., pp. 169, ill., index. New York: Hill Publishing Co., 1909. Price $2.50 net.

The elaboration of the notes taken by a technical man on his rambles constitutes a contribution which is often more striking than a formal treatise. No attempt at systematic presentation is made. Methods are described as they come to the traveler's attention. A large part of the work is devoted to coal, iron, and slate mining in Great Britain. Cave-mining is represented, but details are wanting. It would be impossible for a mine superintendent to adapt much from Mr. Mayer's account of the caving system as practised in its early home. In the account of long-wall work, however, a mass of detail and lucid description, aided by diagrams, enables the reader to appreciate the processes in principle and application. This part of the work, and the minute accounts of the flushing system of mine-filling as practised in Germany, give to the book a high importance. In these particulars it may be regarded as a most valuable presentation of data but little known in America. There are many typographic errors, and others that should have been eliminated in editing. For example, an entire chapter devoted to the famous Cleator Moor mine in Cumberland, is gravely dedicated to Creator Moor.

THE MINERS' POCKET-BOOK. By C. G. Warford-Lock. 5th Ed., entirely re-written, 8vo., limp leather, pp. 624, Ill., index. London: E. &. F. Spon. 1908. Price $4.

This volume is so well known as to require little comment. It has been a handy assistant for practical men for many years, and this new edition has been brought up to date as regards mechanical improvements. For the sake of those unfamiliar with the work it may be stated that it is especially strong in the treatment of methods of transmitting power, shaft-sinking, mining methods, and hauling and hoisting.

Commercial Paragraphs.

W. R. GRANT is now with the MINE & SMELTER SUPPLY CO. at Salt Lake.

The BYRON JACKSON IRON WORKS, West Berkeley, Cal., has recently received a repeat order for two deep-well turbine pumps from the Star Paper Mills Co., Kansas City, Missouri.

The TRAYLOR ENGINEERING CO., Allentown, Pa., is distributing two new catalogues, No. H and V-1, the former on concentrating mills and machinery and the latter on furnaces and smelting accessories.

The WOOD DRILL WORKS, of Paterson, N. J., is distributing, through its New York City and Boston representatives, Harold L. Bond Co., a folder giving the detailed points in the construction of the Wood rock-drill, with the advantages in these special features.

THE C. O. BARTLETT & SNOW CO., Cleveland, Ohio, advises that the new coal handling plant which it has recently installed for the Crows Nest Past Coal Co., at Michel, B. C., was started February 1 and is giving complete satisfaction. The new equipment accomplishes with 17 men in 12 hours what formerly required 68 men for 16 hours.

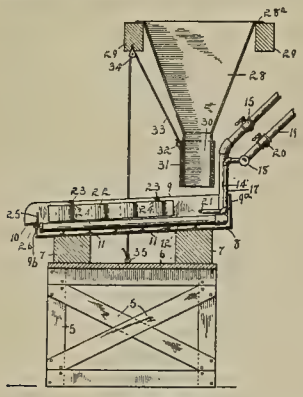
L. VOGELSTEIN & Co., New York, give the following figures of German consumption of foreign copper for the month of January, 1909:

	Tons.
Imports of copper	11,788
Exports of copper	552
Consumption of copper	11,236

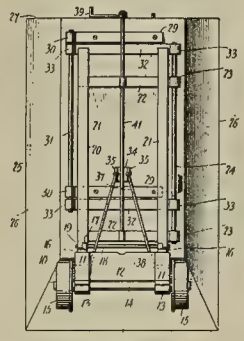
As compared with consumption during the same period in 1908, of 14,160 tons. Of this quantity, 11,125 tons were imported from the United States.

MINING AND METALLURGICAL PATENTS.

PLACER-MACHINE.—No. 912,766. John R. Wood, Chicago, Illinois.



No. 912,766.



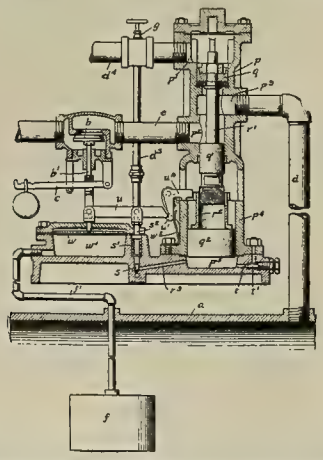
No. 914,925.

In a placer machine, the combination with a suitable frame, a sluice box supported thereon, means for varying the inclination of the sluice box, and a series of riffles in said box, of perforated pipes arranged longitudinally and transversely in the sluice box above the riffles, a spraying nozzle having an expanded mouth adapted to deliver a laterally expanded jet, a hopper arranged to feed the material from above and in front of the spraying nozzle and vertically corrugated amalgamating plates suspended longitudinally above the riffles.

DUMPING-CAR.—No. 914,925. William J. Chance, Dawson, Yukon Territory, Canada.

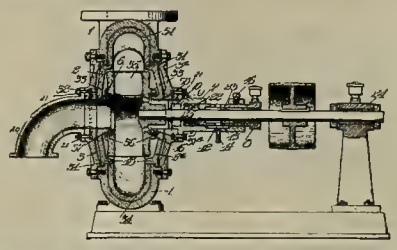
A dumping car comprising a wheeled truck, a frame section, means pivotally connecting the frame section to the truck to permit endwise swinging movement of said section, a body, links pivotally connected to the body and to the frame section, to permit the said body to swing to opposite sides of the truck.

APPARATUS FOR CONTROLLING THE ADMISSION AND RELIEF OF PRESSURE TO TANKS AND OTHER APPLIANCES.—No. 914,497. Edward C. Moore, Philadelphia, Pennsylvania.



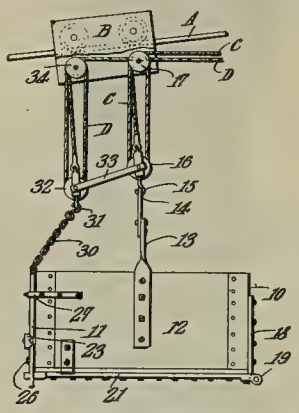
In apparatus for controlling and utilizing fluid pressure, the combination of an appliance to which the pressure is to be applied, a pressure pipe leading to said appliance, valve devices to control said pressure pipe to admit pressure to said appliance, means automatically controlled by the conditions in the appliance to operate said valve devices to admit pressure to the appliance, and devices controlled by the means to operate the valve devices but independent of the conditions in the appliance to control the action of said means to operate the valve devices after said means have been actuated under the control of the conditions in the appliance to operate said valve devices to admit pressure to the appliance.

DREDGER-PUMP.—No. 914,283. Franklin H. Jackson, West Berkeley, California.



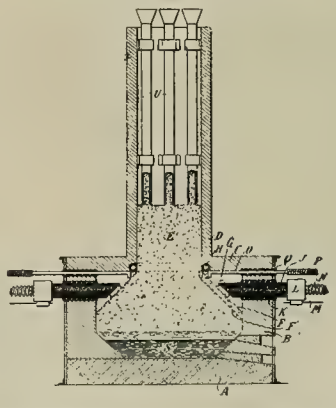
In a centrifugal dredging pump, a shell having a counterbored wall, side liners having outwardly projecting flanges at the rim, fitting the counterbored wall of the shell, said liners converging outwardly toward the centre, and having inwardly projecting annular flanges contiguous to the centre, forming balancing ring and guide tubes for the impeller, and side disks or covers exterior to said liners and bearing thereagainst.

DUMPING-BUCKET.—No. 914,753. Herbert J. Russell, Glens Falls, New York.



In a dumping bucket, a suspension device therefor, a closure for the bucket, a latch for said closure, a pulley, a link pivotally connecting the pulley to the suspension device, a connection between the pulley and the latch, and an operating cable passing over the pulley for raising and lowering the same to operate the latch.

METHOD OF OPERATING ELECTRIC FURNACES.—No. 914,346. Paul L. T. Héroult, La Praz, France.



The method of operating an electric furnace which consists in shifting the face of the charge toward or from an electrode while holding the current terminals stationary; and in maintaining the charge in a substantially vertical column with an inclined face and in passing the current from an electrode to said inclined face of the charge.

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EDITORIAL.

A CORRESPONDENT at Tientsin writes to warn young mining engineers from going to China without a contract or a definite engagement, as the chances for employment are poor at the present time. The American government does not push American enterprise in the Orient like the Japanese, German, or French governments, therefore avenues for employment are not numerous. Fortunately, there is ample scope for American energy in regions under the stars and stripes; young men need not expatriate themselves so long as this continent remains incompletely explored.

PLANS for the Pacific Coast meeting of the American Institute of Mining Engineers provide for a visit to Yellowstone Park, September 25 to 30; at Spokane, October 2 to 6; Seattle, 8 to 11; Tacoma, 12, and Salt Lake City, October 15 to 19. The special train is to leave New York September 22, and return just a month later. The schedule as worked out makes it possible for those so desiring to attend the celebration in San Francisco, October 13, and the American Mining Congress at Goldfield, October 11 to 16, with little loss of time. Large preparations are being made to entertain visitors at Goldfield. Nevada has appropriated $5000 for a special display of minerals, and numerous excursions, including one to Tonopah, are being arranged.

SKINNER'S 'Mining Manual' is a valuable compendium of information and we make use of it often; it is with surprise therefore that we find the name of a company entitled A-Bo-Kou Limited, of which the chairman is Mr. A-Bo-Kou himself, who it appears is a juggler incorporating himself for purposes of business, presumably in the Kaffir circus, a division of the London Stock Exchange. There are others. At Boston there is a clown with a quite fearful command of slang who advertises himself and his stock-jobbing operations, accompanied by financial antics worthy of A-Bo-Kou. Under the guise of a reformer he fooled many of the people for a long time and he has been known to play hocus-pocus with schemes of some merit. It is not necessary to particularize further. In mining camps the gambling den is next door to the saloon; in large cities the bucket shop is the annex of a circus wherein cruel things are done for the merriment of the crowd.

WHEN THE PINCH in silver prices came, the Mexican miners cast about for someone on whom to lay the blame. They found fault with the Government, which is most natural; the whole course of political education in America has taught us that the administration is to blame for all our financial

mishaps. We have no intention to hurl jibes at our Mexican friends; it was cruel luck, and to come down from easy prosperity to the solemn duty of working hard for a living leads inevitably to some grumbling in the earlier stages of the new adjustment. The thing that pleases us is to note how bravely they have fought out their battle, so that even in Guanajuato, which was in greater danger perhaps than most of the rejuvenated silver centres, not a single mine has closed. With silver selling at 50 cents per ounce the district is producing in actual value an amount exceeding the output in the bonanza days of long ago. The modern spirit has dominated; the production is increased in the face of falling prices, costs per ton are reduced, and the world as well as the miner gains by the process. The able engineers at Guanajuato are deserving of high commendation for their fine achievement.

DREDGING for gold is one way of becoming wealthy; it may also be a rapid method of losing money. When a person talks of 'gold ships' and tells you that placer mining is like manufacturing, it behooves you to cock your weather eye. We have been favored with a copy of the letter, pamphlet, and report inviting the public to buy the stock of the Lightfoot Dredging Company, an enterprise incorporated under the laws of Arizona by persons doing business at New York. We are told that "in every gold producing country these wonderful gold ships are producing more than 75% of the world's present yield of gold." The proportion is 2½, not 75, per cent. This affords a scale for measuring the accuracy of the other statements submitted by the promoters of this scheme. Moreover, it is said that 64,000,000 cubic yards of gravel averaging $1.10 per yard can be dredged for 4 cents per yard. This is one of those things that are important if true and delightful if confirmed. When we read the supposititious evidence for these alluring statements we find reason for scepticism. The M.E. who reported on the mine obtained his average of 64,000,000 yards by panning—no drill-tests or shaft-sinking is mentioned. If a single dredge, that is, an operation based on one dredge only, is working for 4 cents per yard, inclusive of all expenditures to be debited against revenue, we would like to know where it is. If the Lightfoot company is to achieve such unusual economy, an explanation should be given. It is probably true that the big dredges at Folsom, with buckets of 13-ft. capacity, have worked for a cost of even 3 cents, but that is in ground of exceptional character. Average results are more nearly exhibited by the two following examples of work done, under excellent management, at Oroville: A dredge having 3½-ft. buckets, digging in ordinary loose gravel and sand, had an average working cost, for six years, of 7.9 cents per cubic yard. Another dredge, provided with 5-ft. buckets, working in tight gravel and clay, showed an average cost, for four years, of 9.9 cents per cubic yard. The second dredge, if operating on the same ground as the one first cited, would operate for 5.6 cents. These figures should be pasted in the hats of would-be dredging experts.

Beam Recrudescent.

Longevity of error has been the subject of much philosophic disquisition. An equally fertile subject would be the periodic reappearance of the mining faker. Among the latter is a certain A. Mills Beam, of old notoriety, now attracting attention in central Missouri. Beam's exploits in connection with the Arkansas black-shale frauds are especially well known to readers of the technical press. By means of false assays a gold excitement was developed in southwestern Arkansas about ten years ago. To the confounding of all other assayers, Beam claimed, by virtue of superior knowledge and methods, to be able to find gold in the material. During a test, at the St. Louis Sampling and Testing Works broken crockery was cleverly substituted for his samples, yet his marvelous methods proved superior even to this obstacle. The details of the transaction were published at the time and have since been frequently re-published as Beam has, at short intervals, come to the surface in other districts. When the Kiowa-Comanche reservation was opened in Oklahoma, a mining excitement developed in the Wichita mountains. Again Beam, this time, however, not alone, for success begets imitation, was able to find gold and silver where reputable assayers found none. Here artistic finish was given to the performance by shipping a carload of the so-called ore to Denver. It was gravely "sampled and purchased" by Beam and a draft for the amount passed through the Lawton bank, to the great encouragement of stock peddlers. A careful sampling of the property by a representative of the Federal Government failed to show even a trace of gold or silver.

In the present case there is the usual story of mysterious westerners investigating an abandoned coal-shaft near New Cambria, Missouri, and of assays made at Denver. A company is formed and enters into negotiation with the 'United States Smelting & Refining Co.' for a plant; Beam representing the latter, refuses to imperil the good name of his company until convinced of the existence of sufficient ore "to assure the success of the enterprise," and is therefore employed to examine and report. Now, remembering that this is a region of Carboniferous limestones and coal measures, as innocent of eruptive rocks as the inhabitants are of mining knowledge, mark what is found. "There appears from general deduction to be a basin here almost surrounded by a coalfield; this basin is undoubtedly an eruptive section. . . . We find a large section of Feldspar assaying gold $135.00, silver $2.50, total $137.50. The chances are it is from a chimney or ore chute nearby." This is in keeping with the blasphemous comment that follows, some of which is unfit for publication: "It is surprising and somewhat out of the ordinary to find gold in an old settled farming country like this. But there is a time for all things; out of the great unknown where He hides His wonders until His people are made ready to receive them and draw this treasure from the earth for the good of fellowman. Solomon, the wisest man the world ever produced well says: 'Gold is where you find it.' So

the gold being here, let the whys and wherefores go unanswered as to how it got there." Even so—especially the last. In view of Beam's record, any question as to how the gold got there might really prove embarrassing. And so the Boone Baldwin Pioneer Gold Mining Co. has been organized with 100,000 shares at $1 per share, and profits of 36½ per cent are estimated—"as we will build a large mill." Of course no stock is being offered for sale; it is much too valuable. All this is old as the hills, even to the detail of having a 'Judge' among the directors. It ought not to deceive anyone, and yet by adroit wording and suppression of facts it has deceived one of our Eastern contemporaries, which gravely publishes a write-up of "the only gold mine in Missouri." This is the greater pity in view of the evident need of public education regarding mining matters in this area. To have a mining journal itself fail under such circumstances to discriminate between true and false is pathetic. Fortunately Mr. H. A. Buehler, the State Geologist of Missouri, has been asked to examine and report on the property. We have no doubt that he will admit a flood of light, and we also have no doubt he will be abused for doing so.

As for Beam, that mild-mannered, soft-spoken gentleman is too old an offender to warrant hopes of reform. Doubtless from time to time he will continue to trail across the stage from obscurity to obscurity like the re-incarnated Mulvaney tootling on the beer bottle at the Queens Praying at Benares.

Rights of Shareholders.

On another page we publish a letter from the manager of the Goldfield Consolidated Mines in which objection is made to certain criticisms appearing lately in these columns. These criticisms were not aimed at the gentleman who makes the rejoinder, but at the policy of the directors by whom he is employed; indeed, even they are only involved in the discussion as having afforded an example of the kind of corporate irresponsibility that is so injurious to legitimate industry, whether in mining, railways, or any other form of human enterprise. We have criticised the Goldfield Consolidated on the score of excessive capitalization and insufficiency of information given to shareholders. There be those who will say that this is none of our business, that mining journals should furnish technical information, and leave financial affairs alone. It is argued that some shareholders do not care whether they receive information or not as long as they get dividends, while others care less for dividends than for enhancement in the quoted price of the stock. One shareholder informed us that he thought 'they' were going "to do something with that stock," meaning that it would be boosted by those in control. He added that there were lots of people who would sell the stock when it went to $2 and mortgage their homes when it was kited to $15. To such persons speculation in mining shares is like the race-track game and mining itself only an excuse for a gamble. To them it makes little difference whether annual reports are issued in good form or are the mere simulacra of information, whether the manager reports to the shareholders as a body or to the privileged insiders who are called directors. On discussing the matter with two shareholders of record, we were informed that they had received no news of the recent discoveries, in fact, no communication save the annual report, which, being experienced mining men, they had thrown into the waste-paper basket, as it gave them no real information concerning the condition of the mine. As one of them said, the only value of the report arose from the fact that it recorded the names of the officers of the company. We do not doubt that the Manager keeps his directors well informed and we are aware that belated information concerning the discoveries was given to the local paper at Goldfield, but how many of the 6000 shareholders see that paper, and what trust can they place in the stuff appearing in its columns? Some of the facts, in garbled form, appeared in the San Francisco papers. Thus, in a haphazard way, the stockholders may have had an inkling of developments at the mine, sooner or later, chiefly later.

This matter is worthy of discussion on a broader basis. The vagaries of individual companies are of small moment except in so far as they establish a bad example. As long as mines are run in the interest of those that control the management, as long as the minority shareholder is considered to have no rights, as long as the operation of mining is merely incidental to gambling, the industry of mining will take rank with other forms of predatory enterprise. At present the public participating in mining adventure consists largely of the clever operators, and their friends, who control the management of mines, and on the other hand, a large number of people who 'play' the stock-market 'game,' as they 'play' the slot machines, the lotteries, the race-track, and other lures for the unwary. Such people neither profit from mining nor do they profit mining. Their fate is dolorous and the people they support are the undesirables of finance. What is needed is the participation in mining of the conservative investor, of the people who buy United States Steel, of sensible speculators of the type attracted by the better kind of mining undertakings listed in London, Boston, and New York. The support of those who regard mining as a legitimate business, instead of a 'game,' will do more to advance the best interests of the industry than all the boosting of stocks. The day of the Comstock and its impudent frauds is gone; the era of clean enterprise, like that of the Lake Superior copper mines, is here. And the only way to enlist the financial support of serious people is by giving them the protection to which as shareholders and co-owners they are entitled.

Mining needs the co-operation of the men of business, not of the mere tipsters and get-rich-quick mob of simpletons; we want to see the day when a banker need not apologize for putting his money into a mining company. And it is for this that we criticise. If our criticisms are not useful, they had better not been made. The policy of this journal is simple: To be interesting by being truthful, and to tell the truth not only in an interesting but in a serviceable way.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

M. L. Requa is at New York.

A. E. Drucker is at Kolar, India.

Nicol Brown is visiting mines in Spain.

F. W. Bradley visited Virginia City this week.

W. Spencer Hutchinson, of Boston, is in Jamaica.

J. George Leyner of Denver was at Salt Lake recently.

C. F. Nourse, of San Francisco, has gone to New York.

William Frecheville has returned to London from Spain.

Robert A. Kinzie is on his way back to Treadwell, Alaska.

Edward T. McCarthy is inspecting the Spassky mine, in Siberia.

G. D. B. Turner, of New York, was in Salt Lake City last week.

Courtenay De Kalb will lecture at Stanford University next week.

C. Colcock Jones is examining properties in the Tintic district, Utah.

Llewellyn Humphreys, of the Gunn-Thompson Co., was at Yerington, Nevada, last week.

B. Britton Gottsberger has resigned as general manager for the Tennessee Copper Company.

D. J. Matheson was in San Francisco on his way from London to Charters Towers, Queensland.

Huntington Adams is manager for the Cia. Minera de Natividad y Anexas S. A., of Oaxaca, Mexico.

Bainbridge, Seymour & Co. have been appointed consulting engineers to the Vagliano Collieries, Limited.

L. C. Trent has opened an office at Salt Lake City, as representative of the Traylor Engineering Company.

Huntingdon Adams has been appointed manager for the Compañia Minera de Natividad y Anexas, of Oaxaca, Mexico.

William Cruyt, manager of the Gold & Platinum Co. of Novita Viejo, Colombia, is on his way from Brussels to Colombia.

Vernon D. J. Hoar, from South Australia, and lately at Kalgoorlie, W. A., is visiting the mines of Nevada and California.

L. V. Cummins, formerly superintendent at Forrest Hill, has been appointed superintendent for the Parlin Mining Co., in Tuolumne county, California.

H. F. Lefevre has been appointed general manager for the Central American Exploration & Development Co., and is now on his way to Bluefields, Nicaragua.

J. E. Spurr has returned to New York after a two months trip of inspection of the properties owned by the Guggenheim interests in Mexico.

E. W. Keith, western manager for the Empire Zinc Co., Denver, Colorado, was recently in Salt Lake City, on his way to the Coeur d'Alene, Idaho.

W. B. Devereux, Sr., and William G. Devereux have been at Rhyolite, Nevada, inspecting the Pioneer Lease, and are now making an examination of the Melones mine, in California.

Obituary.

Jasper R. Rand died March 30, at St. Mark's hospital, Salt Lake City, of pneumonia, aged 34, and after an illness of only a few days. Mr. Rand was vice-president of the Ingersoll-Rand Drill Company, and president of the Rendrock Powder Company, vice-president of the West Quincy Mining Company, and a native of New York State. He was a graduate of Cornell, and during the Spanish war, a lieutenant of engineers. His home was Montclair, New Jersey, but he spent much of his time in New York City and at Salt Lake.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, April 8.

Antimony	12@12¾c	Quicksilver (flask)	44@45
Electrolytic Copper	15¼@16½c	Spelter	6¼@7c
Pig Lead	4.35@5.30c	Tin	32@33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 1. £. s. d.	Apr. 8. £. s. d.
Camp Bird	0 16 3	0 18 3
El Oro	1 5 0	1 5 0
Esperanza	3 0 0	2 17 6
Dolores	1 10 0	1 5 0
Oroville Dredging	0 10 3	0 10 3
Mexico Mines	4 8 0	5 12 6
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 2	12.57	4.10	4.76	50¾
" 3	12.57	4.10	4.77	50⅞
" 4	Sunday.	No market		
" 5	12 57	4.10	4.77	51
" 6	12 57	4.10	4.80	50¾
" 7	12.57	4.10	4.80	50⅞
" 8	12 57	4.10	4.80	50⅞

MINING QUOTATIONS—NEW YORK.

	Closing Prices. Apr. 1.	Apr. 8.
Amalgamated Copper	76½	76⅞
American Smelting & Refining Co	88⅝	89⅝
Boston Copper	11½	11⅞
Butte Coalition	24⅝	24½
Cumberland-Ely	7¾	7¾
Dolores	6½	6
El Rayo	2⅝	2¾
Giroux	8¼	8
Greene-Cananea	10⅛	10⅛
Indiana Sonora	3¾	3¾
La Rose	6⅜	6⅝
Miami Copper	14½	14½
Nevada Consolidated	20	20⅜
Newhouse	3¼	3⅜
Nipissing	10¾	10¼
Ohio Copper	6¾	6¼
Tennessee Copper	41½	41¾
Utah Copper	43½	43¾
Yukon	4¼	4¼

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. April 8.		Closing Prices. April 8.
Adventure	8	Mass	8
Ahmeek	155	Mohawk	62½
Allouez	40	North Butte	72¼
Arcadian	4⅞	Old Dominion	53⅛
Atlantic	12	Osceola	129
Calumet & Arizona	101	Parrot	34
Calumet & Hecla	620	Santa Fe	2⅛
Centennial	30	Shannon	14¾
Copper Range	78	Superior & Pittsburg	13⅜
Daly-West	10	Tamarack	76
First National	6¼	Trinity	14
Franklin	15¾	United Copper Con	12¾
Granby	95	Utah Con	39¼
Greene-Cananea, ctf	10¼	Victoria	4½
Isle Royale	25	Winona	5
La Salle	14½	Wolverine	145

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, April 8.

Atlanta	$ 13	Midway	$ 28
Belmont	93	Montana Tonopah	70
Booth	20	Nevada Hills	1.20
Columbia Mtn	14	Ophir (Comstock)	1.07
Combination Fraction	1.15	Pittsburg Silver Peak	65
Daisy	48	Rawhide Coalition	63
Fairview Eagle	20	Rawhide Queen	40
Florence	3 45	Round Mountain	80
Goldfield Con	8.55	Sandstorm	14
Gold Kewenas	16	Silver Pick	16
Great Bend	17	St. Ives	15
Jim Butler	17	Tonopah Extension	53
Jumbo Extension	20	Tonopah of Nevada	6.75
MacNamara	30	Tramp Con	4
Mayflower	10	West End	33

General Mining News.

ARIZONA.

GILA COUNTY.

(Special Correspondence).—Interest in the operations of the Cactus Development Co. has been heightened by the strike of ore in the shaft on the Arizona National property, under bond to the Cactus. This shaft is down over 250 ft. and has cut a low-grade silicious orebody about 75 ft. wide. The Cactus company will soon start another shaft on the Pinto creek property and will let a contract for 500 ft. W. A. Eaton, of Duluth, president of the company, and C. W. Pritchett, consulting engineer, have been at the property for several days. Operations at Miami are increasing. The ore reserves are now estimated at more than 14,000,000 tons averaging 2¾% copper. Construction work upon the 10-mile extension of the Gila Valley, Globe & Northern railroad from Globe to Miami was started on March 31, and it is expected that it will be finished in four months, perhaps in less time. On the Keystone property, under bond to the General Development Co., a shaft is being sunk, and at 138 ft. is in sulphide and carbonate ore assaying 6 to 7% copper.——At the Live Oak operations are confined to the extension of an old adit at shallow depth, in which years ago sulphide running ½ to 2% copper was opened for 500 ft. This adit has been extended over 140 ft. and is still in ore. It is the intention of the management to start sinking a shaft at an early date.——The Arizona-Colorado Copper Co., whose property is situated about three miles north of Globe, has resumed sinking. On the 800-ft. level a crosscut has passed through 30 ft. of carbonate and sulphide of copper, averaging about 3%. Richer ore in the same vein has been followed for 75 ft.——The Superior & Globe is sinking a development shaft on the extension of the Yuma vein of the United Globe (formerly Old Dominion,) which outcrops for a length of over 3000 ft. This shaft is down about 80 ft. Daniel and Charles Chynoweth, president and secretary of the company, from Calumet, Michigan, stated that the Yuma vein will be thoroughly explored.——Ore shipments from the Superior & Boston to the El Paso smelter have continued at the rate of 50 tons per day. For some time past the ore, which comes exclusively from the Great Eastern mine, has been of better grade, the returns for February averaging 9% copper. The McGaw shaft is down 160 ft. and a raise from the 400-ft. level to meet it has advanced 65 ft. W. E. Carter, the mine superintendent, expects to have the shaft opened to the 400-ft. level early in July. The head-frame is the largest and most substantial in the district, being 65 ft. high and constructed of 16 by 16 in. timbers. The McGaw shaft is a duplicate of the Gardner shaft, having two compartments each 4½ by 5 ft., and one 5 by 7 feet.

Globe, April 1.

GRAHAM COUNTY.

The Standard Consolidated Copper Co. has awarded the contract for treating its ores to the Detroit Copper Co. at Morenci.——The ore taken from the San Jose claims, which is a silver-copper proposition, will continue to be shipped to the Douglas smelter, as formerly.

MARICOPA COUNTY.

George Sayers and Alex. Rose are the proprietors of the Delaware mine in Sayers, 10 miles east of Wickenburg. They have done about 180 ft. of development work, and already have about 100 tons of pay ore on the dump.——Three miles east of Sayers toward Castle hot springs William Kaple is sluicing a placer claim in a small way. In the same district S. Mandrich has an adit 600 ft. long, showing a 10-ft. vein which averages $5 per ton gold.

MOHAVE COUNTY.

The Golden Star Mining Co. has been holding its annual meeting at the mines near Cerbat. There were several of the Eastern stockholders present, including C. Stiles and George Rice, of Philadelphia. A further appropriation was passed to enable the completion of the mill, the machinery for which is now mostly on its way from the builders.——The Gold Road Mining Co. is in course of erecting a 40 stamp mill, entirely equipped with electric motors to be driven by power from Kingman.

CALIFORNIA.

MARIPOSA COUNTY.

Edward J. Mahoney has purchased a group of four mines at Hall's gulch on the Merced river above Bagby. They comprise the Golden Cube, Lucky Strike, Rattler, and the Hidden Treasure, all of which belonged to Ollie P. Whitton, of Merced.

NEVADA COUNTY.

The report of the North Star Mining Co. shows that for the year ending December 31 the production was $1,084,212 for a total outlay of $655,963. The average yield per ton was $12.03 at a cost of $5.26 for operation, $1.29 for development, and 72c. for improvements, etc. On the lowest levels, the 4400 and 4700, ore of good size and value continues to be developed. The inclined shaft was sunk 451 ft., and is now 5400 ft. deep measured on the dip. The last 250 ft. were sunk through vein of fair size but of poor quality. The operations of 1908 have shown the most favorable results yet obtained by the company, with the largest tonnage, largest production and profit of any year in its history.——Grass Valley has been almost excited about two rich ore discoveries occurring within a few days of each other. The last was made by J. H. Bishop at the Native Son mine, near Blue Tent, when he struck a 12-in. vein that carries abundant free gold.——The senior mining students of the University of California are in Nevada City studying the field geology of the region under Prof. Andrew C. Lawson.

PLACER COUNTY.

Two new California properties have been purchased for the Begole Mines Syndicate of Boston. They are situated in Bunch canyon, six miles from Colfax. So far they have never been developed to any extent. There is a single shaft on the property, which has been sunk only 35 ft., assays from which have shown good results. Robert Gross is president of the company.

SAN BERNARDINO COUNTY.

The California Gold & Copper Co. owns nine claims to the northeast of Vontrigger, on the Branwell and Searchlight branch of the Santa Fe railroad. There are three shafts, and about 2000 ft. of underground development, partly in sulphide ore that carries gold, silver, and copper. To treat this the company has devised an electro-chemical process by which all of these will be extracted without smelting. A mill for this purpose is now being built, and some of the machinery has arrived.

TRINITY COUNTY.

The 1600-ft. tunnel of the Trinity River Mining Co. has been completed, and now the Trinity can be turned from its bed, and leave the channel exposed. The tunnel is 7 by 9 ft., and has taken three years work to excavate.

TUOLUMNE COUNTY.

(Special Correspondence.)—The United Mines Corporation has paid off all indebtedness which involved its group of mines near Tuolumne, and within a few weeks complete operations will be resumed. E. A. James, general manager, and J. Mandelbaum, one of the principal stockholders, were here during part of last week, and before their departure all debts, amounting to about $25,000, were paid. It is said that it will require about two weeks to make necessary repairs and alterations before the resumption of operations.——News has reached here of what is supposed to be a valuable strike at the property of the Gold Ship Mining Co., which owns a large tract in the vicinity of Groveland, and through which an ancient river channel crosses. It has been found that the lava covering the channel contains gold in paying quantity, assays going as high as $10. Whether all the lava carries gold is not known, but steps will at once be taken to determine this.——One of the richest ore-

bodies ever discovered in the App mine, at Quartz, was found a few days ago, on the 1300-ft. level. Its extent is not yet known, but enough of it has been exposed to see that the vein is 12 ft. wide, all good milling ore, and with two or three feet of it remarkably rich.——The Los Angeles company which recently secured control of the Hunter, War Eagle, and Hardtack mines, has confined operations to the Hunter, but will begin at the War Eagle in a few days. Power-drills will be used.——The 60-stamp mill at the Harvard mine is in operation day and night, and a full crew of men is employed.——The O'Hara mine, situated one mile north of Sonora, and which during the past twelve months yielded about $150,000, is being unwatered and will soon be worked again by its owner, John F. O'Hara.

Tuolumne, April 6.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence.)—The Pelican mill is now running on day and night shifts, and from 200 to 225 tons of ore are being treated daily. During the last week a King screen was put in, and is said to be effecting a saving. The plant is being fed with dump matter from the Pelican mine, and it is estimated that there are 600,000 tons of material available that will net at least $1 per ton. W. A. Hood is manager.——A 6-in. streak of smelting ore was encountered last week in the breast of the Mollie Gibson adit, situated on Saxon Mtn. The bore is now in 310 ft. and driving is to be continued to open stoping ground. Assays just made show 168 oz. silver per ton, and 14% lead. Chas. Kline is owner.——Development work has been increased this week at the Conqueror, the working force having been added to by 20 men. The main adit is to be driven forward, while stoping will be followed as formerly. The 50-ton mill is running day and night, and the concentrate is being shipped to the Argo smelter. W. S. Pryor is manager.——The Virginia City shaft will be tapped at the 500-ft. level during the present month. There only remains about 30 ft. of ground to be broken before the objective is reached, when the old workings will be drained of water. It became necessary to run the adit 1500 ft. to gain a depth of 500 ft., which is unusual in this locality.——Another strike was made last week on the Josephine, situated on Kelso Mtn. The discovery was made in the breast of the adit, a body of lead ore having been uncovered that is from 18 in. to 2 ft. wide. The first shipment made brought a settlement of $68 per ton in silver and lead. The drift is being extended with all possible speed to permit of stoping, when the output will be increased. John Sapp of Silver Plume is manager.

Georgetown, April 2.

OURAY COUNTY.

An important strike has been made in the Nettie B. mine, on Corbett creek, 3 miles north of Ouray. Assays show 4½ oz. gold, 260 oz. silver, and some lead. The lessees of the mine who have made the strike are Martin Cassanova and Bob Kinley.

TELLER COUNTY.

The new mill at Stratton's Independence has been closed down, and the employees have been discharged without any date being set for their return. It is declared at the office of the company that the shut-down is but temporary, for the purpose of alterations to the roasting plant.——The output of the Cripple Creek mining district for the month of March totalled 60,224 tons of the gross bullion value of $1,382,570, or an average value of $22.95 per ton. The greater part of the tonnage was sent to the Golden Cycle plant.——Monthly measurements at the Roosevelt Deep Drainage tunnel show that the advance in the Portal heading was 340 ft., giving a total of 5587 ft. The average for 13 months is 295 ft. per month.

IDAHO.

James F. McCarthy, manager of the Hecla mine, Harry L. Day, manager of the Hercules, W. Clayton Miller, general manager for the Federal Mining & Smelting Co., and Myron Folsom, counsel for the Bunker Hill & Sullivan mine, were the representatives of the Coeur d'Alene district at a conference at Salt Lake City last week, to protest against the reduction of the tariff on lead ore and pig lead. The delegates of these four Idaho companies, representing one-third of the lead production of the United States, prepared a memorial to be sent to the Western senators and representatives.

SHOSHONE COUNTY.

(Secial Correspondence).—An official report of progress at the mine has been mailed to the stockholders of the Reindeer Mining Co. This report states that the adit is in 2450 ft. and that only 425 ft. are required to intersect the vein. Progress is being made at the rate of 177 ft. per month.——John H. Nordquist has been commissioned to purchase equipment for the Idora mine on Sunset peak. It is intended to equip the property with all necessary machinery for development, and later on a concentrator will probably be erected. All the outstanding debts of the company have now been paid, and the treasury is in excellent shape. A branch of the Idaho Northern railroad will be built into the Sunset region during the coming summer, and when this has been done shipments will be commenced.——It is reported that the property of the Horst Powell Mining Co. on the Little North Fork has been bonded to Finch & Campbell, of Spokane, for $40,000. Upward of 7½ ft. of good copper is exposed in the mine.——Fire broke out in the compressor house of the Anchor mine at Burke last Wednesday and about $700 of damage was done to the machinery and building. None of the men were injured. It is believed that the fire was caused by defective insulation.——It is reported that arrangements have been completed for the erection of a concentrating plant at the property of the Tamarack & Chesapeak Mining Co. The showing in the mine is said to be excellent.

Wallace, April 1.

MICHIGAN.

Recent developments at the Lake mine are encouraging. The north drift on the second level has again passed into rich copper ground after driving through 80 ft. of barren trap. The lode at this point is exceptionally rich in copper, with the mineral more evenly distributed than is the case in the south laterals. On the third level no drifting has yet been done, but a cross-cut has disclosed good ore about 90 ft. from the shaft. It had previously been indicated by diamond-drill holes.——Developments at the Tecumseh mine of the La Salle Co. continue without material change in the underground conditions. The mine is opened horizontally for a distance of approximately 1000 ft. at several levels, mostly in stamp-rock of fair grade. No sinking has been done for nine months, as the full capacity of the hoist has been reached.——At a meeting of the Arcadian Copper Co. the directors gave the New Baltic Exploration Co. an option on the company's interest in section 16. Arcadian will get 5000 shares of stock in the New Baltic Co., when organized, and $40,000 cash.——The Mass Consolidated Copper Co. has extended the seventeenth level cross-cut in shaft A to the lode recently disclosed in diamond-drill operations, and drifting on the lode is now in progress. It shows a width of 12 ft., and is said to be of exceptionally good grade.

MISSOURI.

JASPER COUNTY.

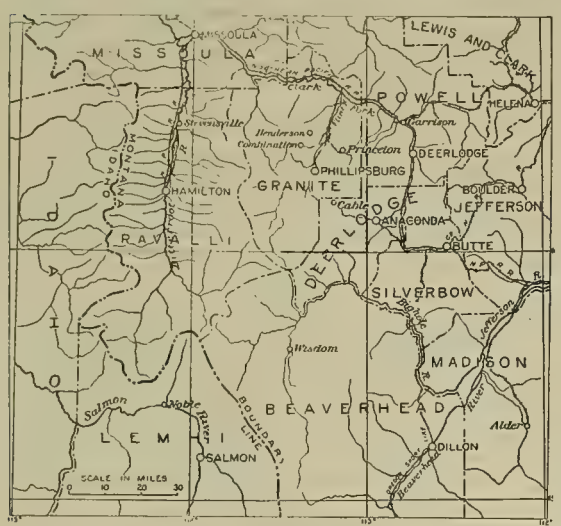
(Special Correspondence).—Resumption of activity is promised in several old tracts in the district which once were rich and well worked, but have since lain idle and become filled with water. At present the Lone Elm tract lying along Turkey creek is being unwatered with centrifugal pumps. Fourteen companies have taken sub-leases and will work the old shallow deposits.——The Mohler-Smith Co., operating at Carl Junction, is again adding to the capacity of its plant. This company recently installed a steam-shovel in the open pit which took the place of 38 shovelers. A 250-ton mill has been on the lease for some time, and a 150-ton plant is in course of construction. A contract is now to be placed for a third mill. The company is operating a deposit in an old bed of Spring river,

which is both extensive and rich.——The 300-ton mill of the Cameron Mining Co. in the Sarcoxie camp is completed and has started operations with two 8-hr. shifts. A flume is being built to the mill from the old Sangamo shaft to furnish mill water, as the shaft of the Cameron could not supply enough.——The J. C. Barr mill of 300 tons capacity in the new sheet-ore zone south of Webb City has been completed, but the initial run has not yet been made. It is being watched with interest, as it is the pioneer in this new field. Several other companies are sinking shafts in the vicinity, but no production is reported up to now.——The 400-ton Meadville plant which was built last year in the Duenweg camp has now been removed to the Rhea Lead & Zinc Co.'s lease north of Webb City and is ready for work. Three levels are being worked, all in the sheet formation.——The Little Persimmon, in the Carthage camp, made its first shipment of zinc-blende last week. This lease has been under development intermittently for a number of years, and has several shafts, but has been operated very little. The deposit is in soft ground and requires heavy timbering; water is also troublesome in the rainy season.——The strike which was made a few weeks ago in the bed of Spring river near Carthage by the Empire Electric Co. while enlarging the dam at Forest mill, continues to increase in richness as work progresses. It is the first strike in that vicinity, and for that reason is important. The Empire Electric Co. will not develop the ore, as it is not a mining concern. The ore is zinc-blende of high grade.

Joplin, April 1.

MONTANA.

There has been a gain of $108,378 in the amount of gold received at the United States assay office in Helena from



Montana.

the various counties in Montana during the quarter ending March 31, 1909, compared with the quarter ending March 31, 1908. This gain is attributed to the fact that numerous new mines, both placer and quartz, have been discovered and put in operation during the last 12 months. The principal producing counties are Fergus, Chouteau, and Madison.

FERGUS COUNTY.

D. J. Burr, a mining engineer, who recently made an examination of the Abbey Cyanide Gold Mining & Milling Co.'s property on the eastern slope of the North Moccasin mountains, near Kendall, says in his report that the orebody is of great size, and is suitable for milling and cyaniding. The shaft has been sunk 200 ft., from the bottom of which a cross-cut has been run 256 ft. Drifts and other cross-cuts show the orebody to be 34 ft. wide and to assay an average of $7 gold per ton.

SILVER BOW COUNTY.

Drifting on the vein on the 1400-ft. level of the Davis-Daly has opened a large body of copper glance. The results are so encouraging that a cross-cut will be at once started on the 1200-ft. level to prove the size of the orebody.——The East Butte Copper Co. has got control of the large amount of water that impeded development work on the 900-ft. level for several weeks.——Owing to the low metal prices no ore is being mined or shipped from the Lexington mine at present. All work is confined to development.

NEVADA.

CHURCHILL COUNTY.

The sinking of the shaft of the Nevada Hills Co., at Fairview, has been discontinued while the drift on the 400-ft. level is being advanced for development. As soon as enough ore has been sufficiently proved, W. H. Webber, the manager, will test for the best method of ore treatment, with the idea of milling his own ore.

ESMERALDA COUNTY.

The Goldfield Consolidated Mines Co., during the month of March, produced 19,351 tons of ore, of which 19,010 were milled in the Consolidated and Combination mills, and 341 were shipped to smelters. The estimated net value recovered from this tonnage is $1,074,020, while the total cost of production amounts only to $124,020. The output of the other mines of Goldfield were valued at only $260,000 for the same period.——Cross-cutting from the bottom of the old Engineers' shaft, at a depth of 500 ft., is being vigorously advanced to reach a point under the bottom of the main shaft, when a 2-compartment raise will be put up to connect with the shaft. On the fourth level, the new work on the Engineers' vein continues in rich ore, and is still of shipping grade, although the width has increased with the advance of the drift.——C. D. Wilkinson, superintendent of the Daisy, says that his mine is in good condition. Much of the ore is worth $150 per ton, and there is abundance of it. The station at the 500-ft. level is about completed, and as soon as the shaft is down to 700 ft. the output is to be greatly increased.——The Mammoth Mining & Development Co. owns the French mine situated at Gold mountain, 40 miles south of Goldfield. A contract for the erection of a 30-ton mill, comprising stamps and Huntington mills, is now being drawn up by Albert Crosby, of Goldfield. The directors of the company are P. and L. Julien, and J. W. Crane, of Goldfield.

NYE COUNTY.

The weekly report of the Tonopah Mining Co. shows that the Mizpah was sunk 13 ft. to the 1309-ft. point. The flow of water has slightly increased, but is only 60 gal. per minute. A total of 408 ft. of new ground was broken in the various workings, 269 in Mizpah ground, 39 in Red Plume, and 100 in Silver Top. This is exclusive of work done in the stopes. An average of 96 of the 100 stamps were dropping continuously in the mill, crushing 3075 tons, worth $22.50 per ton.——All operations in the Stone Cabin shaft of the Jim Butler have been suspended, and it is believed that work will now be done through the Wandering Boy shaft, the repairs to which have just been completed.——Nine hundred and thirty-nine tons were treated at the Montana mill, with an extraction of 85.5%. This low extraction was due to an excess of slime that caused trouble with the settlers, and necessitated the addition of a new one. The underground work shows an advance of 219 ft. in the week. Five days were occupied at the Belmont in repairing timbers in the shaft, at the point where it is intersected by the Mizpah fault. This temporary cessation of ore shipments did not interfere with the operation of the mill at Millers, where a thousand tons of ore were kept in reserve.——From the MacNamara 350 tons were shipped, mostly to the Western Ore Purchasing Co. In future all ore will be sent to the Belmont mill. The shaft sinking advanced 28 ft., giving a total depth of 680 ft.——The total output of the Tonopah mines for the week was 5249 tons, with an estimated value of $131,250.

STOREY COUNTY.

(Special Correspondence).—The weekly output of the Comstock mines has fallen off considerably of late, owing

to the caving of portions of the Sutro tunnel and the repair work going forward at several points. The Ophir and Consolidated Virginia are practically the only mines at present producing, and the yield has dropped to below $10,000 per week. The damage occasioned by the recent fire is being rapidly repaired.——At the Ophir, ore is being taken out from the 2100, 2200, and 2300-ft. levels. A west cross-cut is under way on the 2000-ft. level.——Some development work is under way at the 1950 and 2150-ft. levels of the Consolidated Virginia and ore is coming from the latter point. ——At the Crown Point some fair-grade ore is coming from the surface workings. It is being treated at the Yellow Jacket mill.——A blower has been installed on the 2000-ft. level of the Mexican, to furnish air for the 2200 ft., where considerable work is going on.——The water is being steadily lowered in the Ward shaft and no difficulty is being experienced in handling the flow. Several repairs have been made and a sinking pump is being placed in condition for service.——Repair work is being vigorously pushed in the Comstock tunnel, but owing to the shifting nature of the ground and other obstacles, progress is slow.——The Potosi, Chollar, Savage, and Hale & Norcross have suspended temporarily.——The east cross-cut from the south drift of the Confidence-Challenge-Imperial shaft at the 70-ft. level is progressing slowly in fair-grade ore.——At the Yellow Jacket a raise from the south drift on the 1200-ft. level is in milling ore, while the east cross-cut is also in fair grade rock. The ventilation has been much improved by the installation of air-pipes.

Virginia City, April 3.

WHITE PINE COUNTY.

The Granite district is in the Egan range, 30 miles north of Ely. The best developed property there is that of the Blaine Mining Co.; the principal interested parties therein are D. S. Dickinson, W. B. Graham, James Reilly, and D. Clark, all of Ely. The vein has a porphyry foot-wall and a quartzite hanging wall, dips 31° to the east, and has a width of 3 to 4 ft. There are over 2000 ft. of development, consisting of a 550-ft. incline on the vein, a 925-ft. cross-cut from the side-hill to the vein at the foot of the incline, and drifts on the vein at the 50, 150, 225, and 300-ft. stations, aggregating 400 ft. All the levels will be operated through the cross-cut adit. The ore is a gold-bearing quartz, about 60% of the gold being free-milling and the remainder associated with iron sulphide. Tests of samples indicate a general value of $20 per ton. The company contemplates erecting a 10-stamp mill this year. The Blaine is 6 miles west of Shepherd's station on the Nevada Northern railroad.

SOUTH DAKOTA.

LAWRENCE COUNTY.

Diamond-drill prospecting is progressing on the property of the Elliptic Mining Co., northwest of Deadwood. The work was commenced at the bottom of a 600-ft. shaft, where a station was cut for the drilling apparatus. Driving had previously been started on that level, but without success in reaching ore-shoots. The diamond-drill, however, has struck a free-milling orebody about 600 ft. from the bottom of the shaft, the dimensions of which are not yet definitely determined. The company has started another hole from a point on the surface about 1000 ft. southeast of the shaft.

UTAH.

JUAB COUNTY.

The Tintic smelting plant, now under the superintendency of George G. Vivian, has four lead furnaces of 250 tons daily capacity each, three of which are in operation; and one 250-ton copper furnace, also in blast. The latter is soon to be doubled in capacity. The lead furnaces produce a bullion containing about 99% lead, with 240 oz. silver, and 1 oz. gold per ton of bullion. The copper furnace produces a 40% matte, carrying 250 oz. silver and 2.5 oz. gold per ton of matte. The plant having no converters, the copper matte is shipped to the U. S. Mining & Smelting Co. Besides the tonnage of ore being received from the Jesse Knight mines of the Tintic district, the company has contracts with others in the district calling for 500 tons of ore per day. Among the contract shippers is the Grand Central, at Mammoth, which is getting ready to resume operations after having been closed down for several months.

The May Day, managed and controlled by John Dern, is shipping 500 tons of ore and 100 tons of concentrate per month. The first-grade ore averages 50% lead, and 50 oz. silver per ton; the second grade will run 24% lead and 20 oz. silver. This ore all carries from $5 to $20 gold per ton. The Uncle Sam, under the same management, has been extensively developed during the winter and will soon be in position to make regular shipments. C. C. Griggs is superintendent of both properties.

SUMMIT COUNTY.

The New York mine, under the superintendency of M. J. McGill, has a new shaft, now at a depth of 750 ft., and the sinking in progress will continue till 1000 ft. shall be reached, after which lateral development will be carried on. ——The Grasselli Chemical Co. has in operation a dry concentrating plant for zinc-lead ores, situated near the ore sampler in Park City. The mill, which is equipped with Sutton, Steele & Steele dry concentrators, is in charge of E. Nesbitt, who states that the plant is treating 75 tons per day of zinc, lead, and iron middling from the Daly-Judge concentrator, making a clean separation of the various minerals.

CANADA.

BRITISH COLUMBIA.

J. E. McAllister had posted a notice to the effect that the British Columbia Copper Co. would close both mines and smelter on April 1. Shortly after a committee of smelter men proposed that if the company would agree to continue operations the committee would endeavor to induce all employees to accept a 10% reduction in wages. We do not know if the wage reduction was brought about, but anyhow the manager has reversed his decision, and operations will continue as heretofore.

COSTA RICA.

Phenomenally rich ore is being developed on the Tres Hermanos vein of the Abangarez Gold Fields Co. It is a free-milling ore from which a 5-stamp battery, in a run of eight days, gave a yield by amalgamation alone of $18,000 in bullion.

MEXICO.

CHIHUAHUA.

The Batopilas Mining Co. has been in bonanza ore for the past three months. Two hundred and eight-seven bars of silver, worth about ₱300,000, arrived in Chihuahua representing the February output. For January the output was 205 bars, and in December it was 199 bars. The mines of this company have produced ₱21,712,353 up to December 31, 1908. It is stated on good authority that the management is now planning to build a cyanide plant.

OAXACA.

The dam for the water-power of the Socorro Mining & Milling Co., in the Nochistlan district has been completed. The machinery for the reduction plant is now all on the ground and the mill will be speedily completed. The work is in charge of J. E. McCreary, who has had the contract for most of the mills erected in this district.——The new milling plant of the Carmen mine, in the Sierra Juarez, is giving excellent results. The 1650-pound Nissen stamps are doing more work than had been expected. Callow pulp thickeners, vanners, and Wifley tables are used in concentrating, and the total gold extraction is 93 per cent.

PERU.

The receipts of copper from Peru during the month of February were 6,284,520 lb., which is almost double that of the previous highest month. Nearly all this is from the Cerro de Pasco Copper Co., owned and controlled by the Haggin-Hearst interests. For 8 months of the fiscal year ending with February, there has been received in this country from Cerro de Pasco mine a total of 18,545,095 lb., comparing with 14,899,272 lb. in the same period of 1908.

Special Correspondence.

WASHINGTON.

Proposed Legislature —Department of Mines. — Mining Experiment Stations.—Land Courts.—Leasing Public Lands.

Although the session of Congress just begun was called by President Taft for the purpose of revising the tariff, and it is not likely that there will be much legislation outside of this and census bills, a flood of new bills has been introduced in both Senate and House. A number of them relate to mining, among them being several for either a bureau or a department of mines. Senator Heyburn, of Idaho, has re-introduced his familiar bill calling for a Department of Mines to be under a Commisisoner of Mines. Representative Douglas, of Ohio, who took such a leading part in the previous Congress on this subject, has submitted a bill calling for a bureau of mines, with a Commissioner at its head. This is practically the same as the bill Senator Dick attempted to get through the Senate on the closing day of last session. Senator Gamble and Representative Martin, of South Dakota, have introduced slightly different bills providing for the establishment of mining experiment stations, to aid in the development of the mineral resources of the United States. Mr. Martin's bill is similar except that it places the bureau under the Department of Commerce and Labor instead of the Treasury.

Mr. Austin has presented a bill providing that "no common carrier of interstate commerce shall transport or accept for transportation the products of any factory or mine in which convicts are employed or permitted to work, which products are offered to said interstate carrier by the firm, person, or corporation owning or operating said factory or mine for transportation into any other State or Territory than the one in which the factory is situated." Senator Heyburn has introduced a number of bills relating to the public lands, the most important being one to establish land courts and an appellate land court of the United States. These courts, to be known as District Land courts, according to the bill, would be established in each of the States and Territories that contain more than 2,500,000 acres belonging to the United States and subject to entry or sale. In other States where there is less public land, the nearest District court would have jurisdiction. The District courts are to have jurisdiction to hear and determine all contests involving the right to occupancy, entry, and patent of the lands of the United States. Section 2326 of the Revised Statutes regarding patenting of mining claims is extensively amended. Another bill introduced by Mr. Heyburn provides that the title to mining claims heretofore located by persons holding commissions as United States deputy mineral surveyors shall not be held invalid by reason of the fact that such locations were made by deputy mineral surveyors during their incumbency in office in violation of Section 452 of the Revised Statutes of the United States.

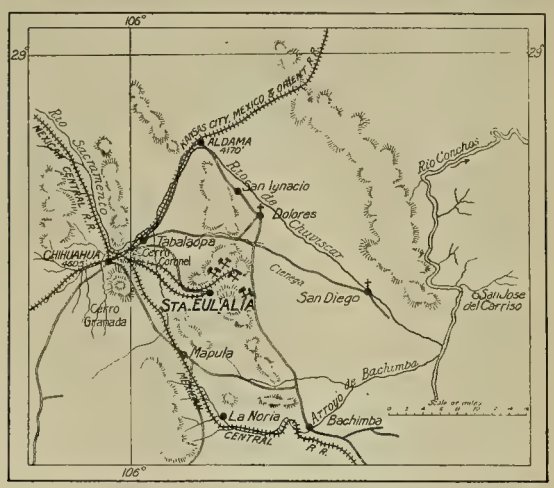
Senator La Follette has presented a bill reserving from entry and sale the mineral rights to coal and other minerals mined for fuel, oil, gas, or asphalt upon the public lands of the United States and providing for the entry of the surface of these lands and also for the leasing of the mineral rights in such lands. Prospecting upon any of the public lands shall be done only by such persons as have received a prospector's license, which will be issued without charge.

A second bill was introduced by Mr. La Follette providing for the valuation of the segregated coal and asphalt lands in the Choctaw and Chickasaw nations in the State of Oklahoma, and for the sale of the surface and the disposition of the mineral rights therein. The bill provides that these lands shall be appraised by a board of three to be appointed by the Secretary of the Interior Department, one of them to be a member of the Choctaw and Chickasaw nations, one who shall have a practical knowledge in the valuation of mineral rights, and one with a knowledge of the land values in Oklahoma. In making the appraisal, the bill provides that the lands shall be classified in areas of 40-acre tracts. It is further provided that the Secretary of the Interior may sell the surface of these lands by sealed bids, at not less than the appraised value and no one person may obtain more than 160 acres of agricultural land, nor more than 640 acres of grazing land. The proceeds of the sale of these lands and the leasing of the mineral rights shall be distributed to the enrolled members of the Choctaw and Chickasaw tribes or nations, and the money to be distributed per capita. The mineral rights are to be rented under conditions similar to those in the first bill.

MEXICO.

Mexican Northwestern Railroad. —Northern Electric Power Co. — Greene-Gold-Silver.—Santa Eulalia Shipments.

A recent change that is of direct interest to the mining industry of Chihuahua is the purchase by F. S. Pearson and his Canadian associates of the Chihuahua & Pacific railroad and the timber and railroad interests of W. C. Greene. For the proper handling of these acquisitions Pearson has organized the Mexican Northwestern Railway Co. of Canada, with a capital of $40,000,000. Of these



Part of Chihuahua.

securities $3,000,000 has been placed in the hands of the Bank of Scotland for sale. The plan seems to be to push the railroads to a connection and thence to the west coast of Sonora. The organizers have had the wisdom to get upon the directorate Enrique C. Creel, Governor of the State of Chihuahua, José Y. Limantour, Finance Minister of Mexico, and E. N. Brown, president of the National Railways of Mexico, and should be free from difficulties with the Federal, State, or railway interests of the Republic.

Canadian capital is also in control of the Mexican Northern Electric Power Co., which is examining the merits of several water-power concessions on the Conchos river in the State of Chihuahua. One of these, known as the Paul Ginther concession, is about 18 miles above the town of Santa Rosalía, and at which point it is claimed 24,000 hp. may be developed. The other is about 20 miles farther up the river, at a point called La Jolla, where it is calculated 16,000 hp. may be obtained. The plan is to furnish power to the mining camps of Parral, Santa Barbara, Naica, Santa Eulalia, and other places. The waste water would be used for irrigation. Another strong company is figuring on a power scheme of like character on the San Pedro river near Rosales, Chihuahua.

Various rumors are afloat regarding the future of the Greene-Gold-Silver company holdings in the Ocampo district of Chihuahua. Both English and New York people are supposed to be looking at the properties. The Concheño mines have reverted to the firm of Corrigan & Mc-

Kinney, which is preparing to resume operations. At the Pinos Altos mines, near by, controlled by the Barnesdales of Pittsburg, preparations are being made for a resumption of operations. The new mill will be completed, two 300-kw. generators are being installed for the transmission of power from the river to the mines and mill, and a motor will probably handle the ores over a surface tram from the mine to the mill. At the Palmarejo mines of the Palmarejo & Mexico Gold Fields, Ltd., near Chínipas, matters are still at a standstill, though some changes either in the construction or the location of the mill will undoubtedly be effected this year and work resumed. The Durango Mines Co. is constructing a 50-ton cyanide plant near Chínipas.

In Santa Eulalia, just outside of Chihuahua, the Santa Eulalia Exploration Co. has resumed operations after a several months' shut-down, and is sending out a better grade of ore to the Chihuahua plant of the A. S. & R. Co. The San Toy Mining Co. is also now shipping to the Chihuahua plant from its immense bodies of lead-silver ore in the Juarez and Galeana claims, and which a number of competent mining men have estimated to be in excess of 10,000,000 tons. The Chihuahua and Potosí mining companies continue shipments of about 300 tons per day in addition to the zinc shipments from the latter company's property. The Potosí M. Co., encouraged by the excellent results obtained by the Calera M. Co., which is controlled by the same interests, in the dry separation of the zinc-blende and galena, is contemplating the installation of a Sutton-Steele concentrating plant. The Madero family continues development at Cuchillo Parado, as does the Chihuahua Copper M. Co. at Chorreros, and some copper is being shipped from San Sóstenes, but were it not for the zinc shipments from Coyame and Picachos things would be quiet on this eastern branch of the K. C., M. & O. railroad.

LONDON.

Borax Consolidated.—Ducktown Copper.—Shan States Tin. — Discoveries in Dolcoath.—Kolar District, India —Nundydroog.—El Oro Developments.—Mineral Production of Great Britain.

Two mining companies operating in America have just been raising additional working capital in London, namely the Borax Consolidated and the Ducktown Sulphur Copper & Iron Co., both of which are exceedingly prosperous companies. The Ducktown company requires funds for the establishment of its new sulphuric acid works, and for this purpose 48,779 shares are being issued at 25 shillings per share. This company has been working since 1891 at Ducktown, Tennessee, and during the last 14 years the ordinary shares have received an average of 18% per annum. Some time ago the law against the emission of sulphurous fumes rendered it desirable to adopt some method of preventing their escape. The annex erected is the ordinary chamber-plant, such as is used at Swansea for saving the sulphur given off in roasting copper ores. The management estimates that the first section will be ready for operation immediately, and the rest of the plant in September. The company is in a favorable position for the sale of sulphuric acid, owing to the nearness of phosphate deposits and to the local demand for fertilizers, and it has entered into a long contract with Charles S. Bryan for the sale of its product at a satisfactory margin of profit. The other company, Borax Consolidated, has been paying since its formation, in 1898, dividends averaging £263,000 a year on a share capital of £2,300,000, and it is now issuing £150,000 new capital for various extensions and improvements. This company, however, never publishes any details, so I am unable to give any information of technological interest in connection with it. The new issues by this company and by the Ducktown company have both been fully guaranteed.

Subscriptions are invited by the Southern Shan States Syndicate. This is the outgrowth of a small syndicate financed by W. B. Dick, who has extensive interests in all kinds of oils. The Shan States are in eastern Burma, adjoining China and Siam, and the territory exploited by this syndicate covers many thousand square miles, yielding all kinds of vegetable and mineral products. The alluvial tin attracted special attention and Euan Smith, who has had considerable experience in Malay tin mining, was sent to investigate. He has issued a detailed report showing the presence of large quantities of gravel running 3 pounds of black tin per cubic yard, and of tin ore outcrops over a wide area. The tin lodes appear to be fairly rich, and they also contain a good deal of wolfram. At the present time, in spite of magnetic separation, wolfram is not a particularly desirable constituent of tin ore, both because the separation is incomplete and because the demand for wolfram is slight.

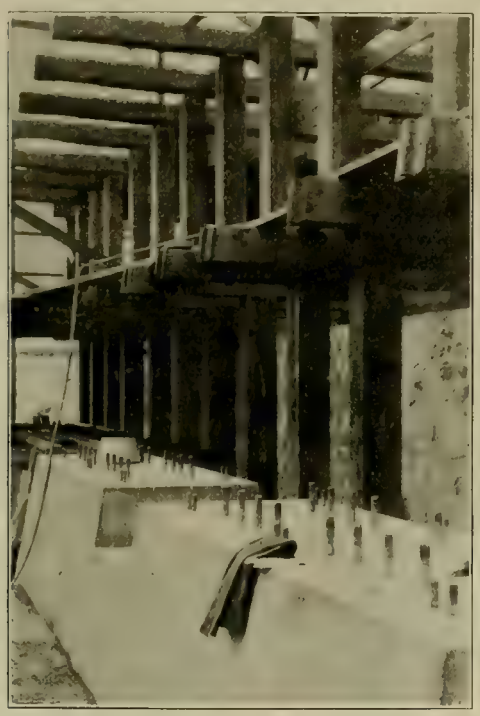
The Ooregum mine in the Kolar district of India has now been working for 21 years. It has had two or three periods of depression, notably 10 years ago and 3 years ago, and it is now recovering from the last. In fact, the output for 1908 was a record, being gold to the amount of £329,317. The total production since the commencement of operations has been £4,866,656, of which £1,595,124 has been distributed as dividends. The average content of the ore at this mine has not been quite so great as at the Mysore or at the Champion Reef in their best days. For instance, the output during 1908 was obtained from 121,886 tons of ore, which is equivalent to about 14 dwt. per ton, and this is an appreciable increase over the last two or three years. The year's profit was £149,998, or £55,543 more than in 1907, and £93,173 was distributed as dividends. The amount of ore reserves on December 31 was greater than ever before, being 154,281 tons, and the ore developed at depth is of higher value than the average of the mine. Consequently the outlook is most encouraging.

Writing of the Mysore mine, I mentioned that at some of the other mines in the Kolar district they were not experiencing the best of luck. One of the misfortunes afflicting the field has been a serious fire at Nundydroog. This fire broke out on January 21 last, on the 1900-ft. level at Kennedy's shaft. For some time it baffled all attempts to cope with it. The only resource available was to allow the water to fill up. By February 17 the fire was extinguished, and pumping was started on the 19th. By March 3 the water was lowered to the 2300-ft. level, and the mill was restarted on the 8th. So far, Henry Richards, the manager, has not been able to ascertain the extent of the damage done. Just as the fire occurred the directors were discussing the amount of the final dividend for 1908, and naturally it was found necessary to pay less than would otherwise have been done, in order to provide funds for repairs. During 1908 the total dividends were £87,258, equal to just over 30% on the share capital. As is done at Mysore, so likewise at Nundydroog, all costs are charged against revenue instead of a portion being met out of new capital. With the exception of the fire episode, Nundydroog has been doing well recently. The reserves of ore have increased and now stand at about 1½ years supply. At and below the 2450-ft. level a wide and valuable orebody has been found, that promises well. During 1908 the tonnage crushed was 87,000 tons, yielding 74,851 oz. of bar-gold in the mill, and 6038 oz. by cyanide, the total output being valued at £303,807. The extraction was 1 dwt. higher than during the previous year. Since the mine started, in 1882, the total output has had a value of £3,319,518, of which £1,427,335 has been distributed as dividends.

Following up his report on the Mexico Mines of El Oro, mentioned by me March 20, R. T. Bayliss has issued a report on the El Oro mine, in which he gives his general impressions of the present state and future outlook of this property. He refers to the hopeful way in which the mine is developing in depth, and mentions that at one point at the 1000-ft. level the ore is running 24s. per ton, which is much higher than the average content of the mine. Mention is also made of the presence of sulphides in the lower part of the mine, but sufficient information has not yet been gained to enable a judgment to be made relating to the nature of the occurrence. In order to facilitate operations in depth,

new means of ventilating have had to be considered, and Mr. Bayliss has advised the sinking of a new shaft to a depth of 1500 ft. It is intended to continue work simultaneously from the surface and from the 486, 786, and 1000-ft. levels, so that the length of time occupied in its construction and equipment will be greatly shortened, and should not exceed 18 months. The mine also appears to have more ore reserves in the upper levels than was at first expected, and there are signs that the so-called barren zone on the 786-ft. level will prove to be of greater value than was originally estimated. Altogether, the mine and mill are in excellent condition.

The British Government issues early information relating to the output of minerals in the United Kingdom. The figures are not final, but are sufficiently close to make them of considerable value to those who want to know as early as possible how things are going. The report issued this week



Mortar-Blocks of the Mexico Mill, El Oro.

deals with the output of minerals from mines during 1908, but not from quarries, the facts in relation to which are not yet ready. The totals for coal, iron, copper, lead, and tin now published may be taken as covering the complete output, but seeing that quite half the iron-ore produced in England comes from open-cut surface workings, and is included in quarries, the figures for the total output are not complete in this case. The output of coal during 1908 was 261,506,379 tons, a decrease of over six millions compared with 1907. Similar temporary set-backs to the upward tendency in the output of the coal have been experienced in 1901, 1893, and 1886. The output of coal for 1908 is just double what it was in 1875. Increases in output are shown in the cases of tin ore, arsenic, and bauxite, but on the other hand the output of galena, blende, copper ore, wolfram, and manganese show decreases. The output of tin concentrate increased from 6079 to 6956 tons. Uranium, which is attracting attention just now, has exactly the same figure for 1908 as for 1907, namely, 71 tons of ore, the whole of which presumably came from the Grampound Road mine, in Cornwall. The fall in the blende output from 20,082 tons in 1907 to 15,189 in 1908 is apparently accounted for by the failure of the Flintshire mines. In this connection it is interesting to note that arrangements have been made for introducing large amounts of new capital to reduce the water-level in the network of mines and tunnels in the Halkyn district of Flint, so that in the near future this part of the country may once more become an important producer of lead and zinc ores.

TORONTO, CANADA.

Cobalt Dividends.—Temiskaming.—Nipissing Statement.—Montreal River District.—Fraudulent Promotion.—Dominion Steel and Coal Companies Compromise.

The dividends paid by the Cobalt companies during the first three months of the present year amount to $1,425,457, or about one half the total dividends paid during the whole of last year, which amounted to $2,849,885. This is exclusive of profits of close corporations such as the Drummond and O'Brien. Dividends have recently been declared by the Nipissing and La Rose, the former being 3% for the quarter, with an additional bonus of 2%, while the La Rose somewhat disappointed expectations by only adding a 1% bonus to its quarterly dividend of 3%. Temiskaming, which was lately subjected to a bear raid, and depressed on account of large amounts of stock being thrown on the market by operators wanting money for Gowganda investments, has recovered itself, owing to favorable reports from the mine, where recently some good discoveries have been made. The latest of these is a 10-in. vein, rich in silver, found in the drift into the Gans lot at the 250-ft. level. The Beaver is another mine the stock of which has been badly depreciated of late. Development has been assiduously pushed, in the hope of picking up some of the rich Temiskaming veins, but so far without results, and the finances of the company were exhausted. At the annual shareholders' meeting on March 27 the situation was explained by the management, and authority was given the directors to increase the capital stock from $1,500,000 to $2,000,000, the new issue to be put on the market at not less than 10% of its par value. The financial statement of the Nipissing shows cash, bullion, ore *en route* to the smelters, and ore at mine, to the value of $1,009,000. The ore ready for stoping is valued at $700,000 more than on January 20. A strike was made this week on the Peterson Lake leasehold of the Little Nipissing, a good pay-shoot being found at the 150-ft. level on a vein on which considerable driving had been done. It is about 10 in. wide, containing calcite and native silver.

There has been a good deal of activity shown lately in the installation of mining plants in the mines of the Montreal River district. At the Moose Horn a complete 3-drill compressor-plant is being put in. At the Otisse-Currie a 9-drill compressor, with boilers, etc., has been installed. The Gavin-Hamilton has a 6-drill compressor and 65-hp. boiler, and four air-drills on the ground. The shaft on this property is down 57 ft., and driving has begun. The Big Six is putting in a plant comprising two 40-hp. boilers, one 4-drill compressor, and 4 drills.

Another fraudulent mining promoter is being prosecuted. William Joel of Toronto organized the Gowganda Silver Premier Co., capitalized at $500,000, with men of straw as directors, securing for low figures 8 Gowganda claims, on none of which had silver been found. He attempted to dispose of the stock by means of circulars, making statements as to rich discoveries made on the properties. He was arrested before he had time to secure many victims, and is now on bail awaiting trial.

The Minister of Mines has introduced a measure in the Provincial Legislature to amend the law respecting mine accidents, based on a report by Mine Inspector Corkhill. Greater safeguards are provided in connection with the use of explosives, miners being prohibited from drilling at the bottom of old drill-holes, where unexploded charges often remain. It is provided that the Inspector of Mines must be present at all inquests on mining fatalities, to bring out the essential facts. Cross-heads are required to be constructed on such a plan as to insure the bucket stopping as soon as the cross-head sticks in the shaft. Penalties for the violation of mining regulations are increased, and imprisonment is provided where neglect is deliberate.

The fear entertained that the interruption of communi-

cations with Gowganda by the breaking up of the winter roads might be attended with famine, is declared to be unfounded. For some time supplies have been steadily taken in, and the requirements of the camp for months ahead are fully anticipated. J. M. Laing, president of the recently organized Gowganda Board of Trade, publishes a statement to the effect that no danger need be feared. There are 1050 tons of supplies in the hands of merchants. Six hundred teams are engaged in transporting goods to the camp from Charlton, and 200 are similarly employed on the winter road from Sellwood. The government of Ontario has appropriated $50,000 to construct a permanent wagon road to Gowganda from Charlton. The project of a railway from Sellwood to Port Arthur, which would serve the Gowganda district as well as a rich unsettled agricultural region, is likely to take practical shape, the government having offered a grant of 2,000,000 acres of land as an inducement to the Canadian Northern railway to build the road, which must be commenced within a year and completed before the end of 1913.

The long-continued litigation between the Dominion Iron & Steel Co. and the Dominion Coal Co. is at length being amicably settled. The Dominion Coal Co. has paid over $2,750,000 on account of the damages for which the courts declared it liable. The old contract for the supply is recognized as still in force, and the Steel company is to furnish a detailed statement of its claims for losses and to allow the Coal company to examine its books. When this has been done the parties are to endeavor to arrive at a settlement, before the assessment of damages by the referee as ordered by the courts.

BUTTE, MONTANA.

March Output. — Streams Pollution. — Pittsmont.

Operation in the Butte mines during March aggregated about 29 days of actual mining, and the production for the month is estimated at 28,077,510 lb., the various companies contributing to the totals as follows:

Companies.	Ore, tons.	Copper, lb.
Boston & Montana	102,950	7,618,300
Anaconda	108,750	6,851,250
Butte & Boston	18,850	1,187,550
Washoe	17,400	1,061,400
Parrot	12,325	714,850
Trenton	12,960	740,080
North Butte	40,890	3,761,880
Butte Coalition	38,425	3,074,000
Original	27,550	2,093,800
Pittsburg & Montana	8,700	626,400
Miscellaneous	4,350	348,000
Totals	392,950	28,077,510

Judge Hunt, in the United States Court, has given another important decision in favor of the smelting and mining companies. Hugh Magone, a rancher, in a suit against the Anaconda, Montana Ore Purchasing, Colusa-Parrot, Parrot, Colorado, and Butte & Boston companies, demanded $20,000 as damages and an injunction, claiming the tailing polluted the streams and irrigating ditches and damaged his land in the Deer Lodge valley. Judge Hunt found that the actual damage did not exceed $1726, and that the Anaconda company, owner of the Washoe smelter, did not contribute to the damage. The findings of the Court practically dispose of the injunction question, though Judge Hunt did not directly pass on that. By passing control of the Pittsmont Copper Co. to financial interests in Boston, that company will be provided with funds. The company has been paying about $20,000 per month interest on bonds. Even at its present limited earning capacity the company pays that interest, all its operating expenses, and furthermore places something in the treasury each month. By diverting the $20,000 interest to the treasury and doubling the output of the mines and smelter, which can easily be done, a good treasury and dividend-fund can be accumulated.

VICTORIA, BRITISH COLUMBIA.

Crows Nest Pass Coal Co.—Reciprocity in Coal.—Canadian Zinc.—Le Roy Mine.—New Stamp Mill.

At the recent annual general meeting of the Crow's Nest Pass Coal Co., G. G. S. Lindsey, Robert Jaffray, Sir Henry Pellatt, and E. R. Wood, all directors for a number of years, declined re-election, following the intimation by W. P. Clough, representative of the Northern Securities Co., that the American interests, which hold about 60% of the stock, desired to have the affairs of the company administered in the future in St. Paul. The Canadian directors refused to become part of what would be equivalent to a dummy board. The new board consists of W. P. Clough, Jay P. Graves, and five Canadians, one of the last, Elias Rogers, being president of the company.

The production of coal in 1908 was 981,645 tons, as compared with 981,939 tons in 1907, and 806,901 tons in 1906. Of the output 262,558 tons was made into coke in 1908, 231,368 in 1907, and 213,295 in 1906. The aggregate output since the company commenced coal-mining in 1898 is 6,217,399 tons of coal. The net earnings in 1908 were $240,226, as compared with $382,986 in 1907, and $351,791 in 1906. The aggregate of net earnings for nine years, 1900 to 1908, is $2,820,453, of which $2,384,652 has been distributed to the shareholders in dividends. Only one dividend was paid in 1908, amounting to $185,825, as compared with $355,179 in 1907, and $350,000 in 1906. No dividend was paid for the second half of 1908, owing chiefly to losses totaling $106,712 from the fire which destroyed the town of Fernie last year. To the same cause, together with trade depression and the increased cost of mining, was attributed the material decrease in net earnings of the year. During the year several years' accumulation of premiums on stock sold, amounting to $2,141,250, was paid as a bonus dividend at the rate of 66⅔% on the capital stock of the company to shareholders subscribing for new shares equal in amount to the dividend. By this the issued and paid up capital was increased to $6,212,666.

The company has withdrawn from the Western Coal Operators' Association and has agreed with representatives of its miners on all important points in the new scale to go into effect April 1. Ten mines are operated. Only two of these are at present shipping, but others will shortly also produce coal. The total output for April is expected to be 4000 tons daily. It is intended to make it 6000 tons by next October and 8000 tons three or four months later. The erection of 1000 additional coke ovens at Fernie will be commenced this year. The company employs about 2000 men, and has an assured market for all the coal and coke it can produce. The output for the current year to March 26 was 185,160 tons. Adding about 8400 tons for the remaining three days the mines were worked, a total of 193,500 tons for the quarter is obtained.

The proposed removal of the duty on coal imported into the United States, has not moved coal mine operators in British Columbia and Alberta to any action favoring reciprocity, despite the fact that the establishment of free trade in coal between the two countries would bring about a substantial increase in Canadian production. On the other hand, coal mine owners in the neighboring State of Washington are very much opposed to the reduction. At present the duty on coal imported into the United States is 67c. per ton, while the Canadian duty is 53c. The Washington operators are at serious disadvantage even with the existing duty. The chief advantage of British Columbia coal is that of superior quality. Furthermore, Oriental labor is used to some extent at Vancouver island coal mines, about one-fourth of the employees being Japanese and Chinese, and the average wages paid to these is less than to men working in the Washington mines, which do not employ any Orientals. Under existing conditions British Columbia coal mines ship a large proportion of their product to the United States. The figures for 1908 are not yet available, but in 1907 nearly 30% of their gross output, or, after deduction of coal used in making coke, etc., about 40% of the net output went to this market. There is an

abundant supply of bituminous coal of excellent quality, both on the coast and in the interior of British Columbia, and there are good transportation facilities. The latest available figures of production show that British Columbia's gross output of coal in 1908 was 2,109,000 long tons, that of Alberta 2,046,308 tons, and of Saskatchewan, for the fiscal year ending February 29, 1908, 189,428 tons. The estimated production of the coal mines of the State of Washington in 1908 was about 3,000,000 short tons, of Oregon 25,000 tons, and of California and Alaska together 55,000 tons. It is probable the development of the coal resources of British Columbia and Alberta will be much more extensive in the early future than of the Western United States. As bearing upon Canada's probable attitude toward reciprocity, it may be mentioned that Nova Scotia coal mine owners are strongly opposed to the removal of the existing duty, claiming that they will lose their hold on the Canadian market as far west as Montreal. One result would be that they would find their main market in the New England States. As Ontario and Manitoba get their main coal supplies from the States, the removal of the duty would benefit consumers in those provinces.

At the annual meeting of the Canada Zinc Co., held at Nelson on March 30, last year's officers and directors were re-elected. The company late last year commenced at its works at Nelson the separation and reduction of lead-zinc ores in an electric furnace. The work is being re-organized and extended. Retimbering of the Le Roi No. 2 Co.'s main shaft at Rossland has been completed to the 500-ft. level.

GOLDFIELD, NEVADA.

Consolidated Output.—Florence Goldfield Production. — Hornsilver District.—Silver-Lead Ore at Hawthorne.

Prospects of an extra dividend from the Goldfield Consolidated Mines Co. at the time of the next quarterly distribution of profits, 90 days hence, have been rendered a practical certainty by recent developments in the company's mines and the unexpectedly heavy bullion production from its two mills. In an official statement issued by the secretary of the company it is set forth that during the month of March the company produced 19,351 tons of ore of which 19,010 tons were milled in the Consolidated and Combination mills and 341 tons shipped to the smelters. Local mills are not designed to treat the very rich gold ores, the greater saving from which, effected by the smelting process, more than offsets the cost of transportation. It is stated officially that the net value recovered from the March output is $1,074,020, estimated for the reason that some of the bullion is still in transit to the mints and some of the ore in transit to the smelters for which definite returns have not been received, but the estimate is declared to be conservative. The total cost of production, including all expenses of mining, milling, transportation, and office, was $124,020, leaving a net profit of $950,000 as a result of the month's operations. The 341 tons of ore sent to smelters represents that which has been broken from the high-grade streak in the new Combination ore-shoot, which runs from $800 to $1500 per ton and contains seams carrying as high as 200 oz. gold. This rich streak, which is from four to six feet wide, is a red-brown oxidized ore running through the centre of the great vein of gray sulphide, the whole mass being 40 ft. wide and yielding an average throughout of $190 per ton. At the present rate of bullion production the Consolidated company is earning sufficient to pay ten, instead of four, dividends annually of 30c. per share. Mining men generally are greatly pleased over the acquisition by H. C. Frick and Charles Hayden of the interests in the company formerly held by Senator George S. Nixon.

A conservative estimate of the bullion output for the Goldfield district during March places the figure at $1,300,000, including the Florence Goldfield with $98,000, Combination Fraction $85,000, Daisy $35,000, other producers being led by the C. O. D. Consolidated and the Consolidated Red Top lease. The Daisy is making daily shipments of ore averaging around $150 per ton, has a fine showing of high-grade ore on three levels, and the manager, C. D. Wilkinson, is cross-cutting for the main vein at the 500-ft. level while the double-compartment shaft is being sunk to the 700-ft. point. The importance of the strike made some time since on the Gold Bar claim of the C. O. D. Consolidated has been established by means of a raise that has been made from the 300 to the 200-ft. level, in ore containing seams of high grade. This ore shows free gold and tellurides, as well as copper. The shaft is now being sunk from the 300-ft. level and within a few days the work of exploring the ground from the 600-ft. level of the adjoining Nevada Gold Ore Mines Co. will begin.

In view of the relatively small amount of development work performed by the Florence Goldfield Co. and the fact that the new mill has been employed exclusively in the treatment of low-grade ore, chiefly from old dumps near the company shaft, the production of nearly $100,000 in March is conceded to be most creditable, and when the main shaft is connected with the lease workings, making available the better grades of ore, it is expected that the company will be able to make a production of $2,000,000 annually. The March product consisted of 4000 tons averaging $20 per ton, treated in the mill, besides 23 tons of high-grade, worth $800 per ton, which was shipped to the smelters. The rich ore came from a new strike made recently in running a connecting lateral from the company workings to those of the old Little-Florence lease in which a foot of extremely rich ore was cut, accompanied by about two feet of medium-grade stuff. This ore is now being stoped. Another rich ore-shoot has just been opened at the 500-ft. level of the old Engineers' ground. The Florence mill is working satisfactorily. With the installation of another tube-mill and additional amalgamating plates the entire equipment of 40 stamps will be brought into commission and a treatment of nearly 200 tons daily assured.



The Beginning of the Combination Mine, 1903.

A splendid extraction of ore, both in point of quality and tonnage, is being made from the Combination Fraction mine and the managers confidently predict a million-dollar yield for the year. Nearly 100 tons daily of ore averaging around $50 per ton is being treated at the Nevada Goldfield

mill, which the Fraction company has under lease, and beside a large tonnage of excellent mill-ore the property has exposed high-grade in veins that are extensons of those in the Mohawk. Beside the ore being treated locally, the Fraction has been sending out shipments of high-grade to the smelters. It is believed that the new Combination vein will be encountered on its dip in the Fraction ground at a depth of 500 or 600 ft. and the management is now considering the installation of a drill to prospect the territory at great depth. A large tonnage of good mill-ore, together with some of the richer rock, is in sight in the workings of the Little-Florence company, whose lease covers the southern portion of the Combination Fraction.

A production of approximately $30,000 monthly is being maintained by the Consolidated Red Top lease, operating on the Red Top, and another $20,000 dividend will probably be announced at the meeting of the directors in a few days. This company has opened a large deposit of oxidized ore at the 300-ft. level. The Red Top Mining & Leasing Co.'s shaft, on the adjoining Bull Dog Fraction, is nearing the 400-ft. mark and should encounter the Red Top vein near the 500-ft. level.

Rich ore is being stoped in a raise in the Stoneham-Moore-Griffiths lease on the Combination No. 1 and 2 claims, the shipping ore having been encountered in a strong vein at a depth of nearly 500 ft. The double-compartment shaft of the Grizzly Bear Co. on the Jumbo group of the Consolidated is now more than 350 ft. deep and is being sunk rapidly by the manager, Bruce Jones, for the 800-ft. level, near which it is expected that the great Mohawk vein will be penetrated. The strongest ore-shoots of the Mohawk, including that of the famous Hayes-Monnette lease, dip directly toward this shaft and the company will still have a year's time in which to operate after that depth is reached.

Lessees on the territory of the Goldfield Merger Mines Co., the Codd lease, and the Kansas City Velvet lease, are taking rich ore from within 100 ft. of the surface on the St. Ives and Velvet veins and will penetrate these veins at depth. The Combined Mining & Leasing Co. is running a cross-cut to the junction of these veins, at which point good ore is expected. The Fairview-Cherokee lease on the Atlanta, the most important on that property, is equipped for extensive mining and has begun to drift on a great quartz lode that intersects the main Jumbo vein on this ground.

The Hornsilver district, 30 miles south of Goldfield, is making a regular production of ore from the Great Western mine, the product being shipped to the reduction works at Millers after being hauled 15 miles to the railroad at Cuprite. As greater depth is attained in this mine the ore is changing from silver to gold contents. On the Orlean group 8 ft. of shipping ore has been exposed, while a good tonnage has been opened in the Frances Lime Point lease which has made several small shipments to Goldfield. The Broken Hills mine at Helena is making a heavy production of high-grade ore from its three shafts and from several surface cuts from which the rock is sacked directly for shipment. The company is building a 50-ton mill and has exposed a big tonnage of excellent mill-ore in addition to the high-grade. In the Whitmore lease a body of rich ore has been opened and two shipments have been made.

Hawthorne is attracting attention on account of the rich silver-lead ores being produced by the Lucky Boy and Alamo mines. The Hubbard lease on the latter has been making a production approaching $20,000 daily and employing nearly 200 horses in hauling the product to the railroad. Many Goldfield operators have secured claims or leases. Mitchell & Fairfield have recently paid $35,000 in cash for a lease on ground joining that already owned, and have shipped three hoists into the district. C. C. Hyllested, of this place, has secured a bond and lease on the Hardscrabble group, adjacent to the Alamo, and claims to have shipping ore at the surface. There is great activity all along this mountain range, south of Walker lake. A Chicago company is developing what is said to be a copper property and a fine showing of ore has been made on the property of the Forrest Mining Co., whose property is not far from Dutch creek.

KALGOORLIE, WESTERN AUSTRALIA.

Gold Output.—Water Supply.—Placers.

The corrected figures of gold production in this State for 1908 were as under: 1908 output, $34,950,000 against $36,000,000 in 1907; 1908 dividends, $7,400,000 against $8,600,000 in 1907. During the period, the Perth Mint dealt with gold valued at $27,400,000. Coined gold exported totaled $23,000,000. Uncoined gold exported totaled $9,450,000. The January yield was $2,800,000, of which the Mint received $2,050,000.

Coolgardie is now a dead district, a number of small free-milling mines only keeping the place alive. Several large low-grade lodes are known, but these are merely pottering with 10-stamp batteries. From time to time attempts have been made to work by sluicing and dredging the auriferous gravels that cover a large area around the mines on the east side of town, but so far without success. As high as $1 per yard has been caught, but the expense of water, uneven bottom, etc., ate up any possible profit. In 1908 Coolgardie produced gold valued at $850,000, against $1,290,000 in 1907.

What has been written about the gravels at Coolgardie applies also to Kalgoorlie. Every attempt to work them by water has failed, yet dryblowers have turned over the same stuff repeatedly, and apparently make a living by it. Just out of the town of Kalgoorlie there are many million yards of gravel of an average depth of say 4 ft. resting on what is known here as a cement bottom. It would be almost impossible to form an estimate of its value, although trials have given 50c. per yard.

The maintenance of the main of the Goldfield's water supply is a heavy expense now on account of internal and external corrosion. During the period 21,200,000,000 gal. ran to waste, and at present 4,140,000,000 are in the reservoir.

January outputs from the leading mines were:

Name.	Tonnage.	Yield.	Profit.	Dividend.
Associated	11,007	$113,000	$33,000	.....
Associated North. Blocks.	3,750	37,000	†600	$260,000
Golden Horseshoe	22,656	260,000	100,000	.....
Golden Link	*3,802	35,500	4,400	.....
Golden Ridge	2,200	27,500	13,000	.....
Gt. Boulder Proprietary	16,460	245,000	130,000	.....
Gt. Boulder Perseverance	18,156	155,000	55,000	175,000
Great Fingall	14,436	75,000	8,500	62,000
Hainault	5,548	32,500	2,000	.....
Ivanhoe	19,505	210,000	105,000	250,000
Kalgurli	10,750	145,000	81,000	185,000
Kalgurli South	9,038	62,000	12,000	.....
Lake View Consols	‡*7,733	55,000	12,500	.....
Oroya-Brownhill	‡11,565	95,000	29,000	.....
Oroya-Black Range	4,500	56,000	20,000	.....
Sons of Gwalia	13,498	100,000	32,000	.....
Sons of Gwalia South	1,905	22,000	3,500	30,000

*Crushed in same mill. †Loss ($13,000 dividend duty). ‡Cassel plants working on dumps. Oroya-Brownhill treated 20,443 tons of old residue by Cassel process for a return of 80c. per ton, costs being 60c., leaving 20c. profit, which is rather small.

From time to time, in various outlying districts, the Mines Department of Western Australia has erected 10-stamp mills, to crush the ores from prospects. Generally a sand-treatment plant is installed, and now it is proposed to erect a few Cassel plants. These batteries have been of immense benefit to parties of men working small prospects. At the same time the battery managers, and of course the Department, came in for a great deal of abuse from those crushing. Sometimes they are dissatisfied with the treatment, or the yield, or the milling charges; though the latter are now very low. In 1908, the State mills dealt with

Golden Horseshoe announces its ore-reserves at December 31, 1908, as 1,065,409 tons at $12.20 per ton.

In the annual report of the Goldfield's Water Supply, the following data are published:

	Gallons.	
Consumption during year	837,296,000	
Daily average	2,294,000	
Mines' Supplies	397,944,000	
Domestic and railways, etc.	440,352,000	
Total revenue		$860,000
Operating expenses	$374,000	
Interest, supplementary capital.	52,000	
Sinking fund, supplementary capital	32,000	
Interest, main capital	457,000	
Sinking fund, main capital	400,000	
		1,315,000
Deficiency		$455,000

JOHANNESBURG, TRANSVAAL.

Chamber of Mines on Labor. — Low Costs and Ore Reserves. — Gold Yield.—Stope-Drill Competition. — Natal Resources.

Two great speeches are delivered every year by leaders of the mining industry; these are regarded as the most important pronouncements—being authoritative, comprehensive, and always carefully prepared—upon the progress of affairs and the prospects for the future. One of these is the Chairman's speech at the meeting of the Rand Mines, Ltd., and the other is the valedictory address of the President of the Chamber of Mines. Lionel Phillips made admirable use of the latter opportunity for addressing the Rand's 'financial constituents' on February 26, and being more fortunate than his recent predecessors, he was able to discuss the lessons of a wholly prosperous and progressive year. Nearly every point calling for notice seemed to provide cause for satisfaction. The troubled question of unskilled labor—the jarring note in so many past presidential addresses—was discussed straightforwardly in a brief history of recruiting operations since the war. As it was possible to record an increase of 33,227 native employees during the past year, the subject can give rise to no immediate anxiety. It is common knowledge that the renewed attempts to employ white men on unskilled work underground have not proved economically successful. At the same time, Mr. Phillips acknowledged the duties of the mines to the community in regard to the relief of distress among the unemployed. Upward of 3000 unskilled whites were taken on during the 8 months ended December 31, 1908. One direct advantage to the mines resulting from their employment has been the availability of a standing force of men, from which the good workers can be speedily picked to fill openings in the high branches as soon as they occur.

The reduction of working costs was discussed in its broadest and most attractive aspect. Analyzing the position of 67 representative mines, Mr. Phillips found that the fall of 2s. 4d. per ton in working costs allowed the inclusion of an additional 5,400,000 tons (an addition of 9%) in the ore reserves. He also pointed to the relation between costs and yields per ton. As the former are decreased so are the latter brought down by the utilization of formerly unprofitable rock. The influence of this has often been taken to indicate an impoverishment in depth, of which—below the surface zone of enrichment—there is no evidence. The yield per ton has fallen because of the reduced selection in underground schemes of exploitation. Mr. Phillips stated: "I do not think we have anything to show that the conglomerate beds at three or four thousand feet in vertical depth are any less productive than they were at one or two thousand feet." This declaration expresses no cursory view, but can be based on a careful examination of detailed figures collected from all parts of the Rand.

Mr. Phillips anticipates that the tonnage of the ore milled this year will exceed the 1908 total by about 3¼ or 3½ million tons. Applying this to the Transvaal totals, we may deduce the following:

1908.....18,755,000 tons at 31.5s. = £29,957,000
1909.....22,000,000 tons at 29.5s. = £32,450,000
or 1909.....22,000,000 tons at 30.0s. = £33,000,000

The President of the Chamber of Mines did not commit himself to the probable yield per ton, but the two estimates given appear to allow ample for the reduction coincident with a further fall in working costs.

It would be easy to attach too much importance to the early results of the Stope-Drill Competition, the elimination trials of which are now proceeding at the University College, but enough has nevertheless been done to prove conclusively that the past year has been well employed by manufacturers. Some rapid drilling has been done by the Westphalia, Flottmann, and Climax Imperial drills. The New Century also made a good showing, but this drill is used without supports and seems to put so great a strain upon the strength and endurance of its operator that it is unlikely to meet with favor in working practice. Four drills of promise—the Chersen, Waugh, Konomax, and Murphy—have not yet been tried. Bearing this in mind, brief reference may be made to the best performances chronicled to date.

The Flottmann took part in the competition of a year ago, but its design has been changed. It is of the hammer type, fed by hand-screw, with a 2½-in. diam. cylinder and 2¾-in. stroke, and weighs 87 lb. With a consumption of 193 cu. ft. air per foot drilled, it averaged in two tests 4 in. per minute during actual running time and 2.18 in. during total time. The Westphalia—a 'dark-horse' arriving from Germany, and of which little was known in Johannesburg—is an automatic-feed hammer-drill, weighing only 65 lb., with a cylinder diameter and stroke of 2⅜ in. It is high in air-consumption, two tests showing 224 and 299 cu. ft. per foot drilled. The Westphalia's two tests gave 4.996 and 3.421 in. per min. while drilling, or 2.675 and 1.944 in. through the tests. Corresponding figures for the 'Climax Imperial' were, for two tests, 3.842 and 3.198 in. per min. on drilling time and 2.416 and 1.910 in. on total time, with air-consumption at 209.8 and 261.5 cu. ft. per foot drilled. This machine, also of the hammer type, has a 1-in. cylinder and 4¾-in. cylinder stroke. Hollow steel is used. It only falls below the 100-lb. maximum weight by 2½ lb. Feeding is performed of ordinary hand-rotation. The great improvement effected in these hammer-drills may be judged from a comparison of the above figures with the record of the Gorden drill (not competing today) at the trials of a year ago. The mean results then shown were as follows: Depth drilled per minute: total time (1) 1.11 in.; (2) 1.8 in.; actual drilling time (1) 1.6 in.; (2) 2.15 in. The elimination trials now in progress will disqualify several drills for the full tests to be undertaken later.

In spite of an active policy of State aid to prospectors and bonuses to pioneer producers, Natal mining has been developing very slowly. The colony's coal deposits have long been exploited and now produce upward of 1½ million tons of high-class bituminous coal per annum, principally for railroad and ocean-steaming purposes. A wide range of other mineral resources are found, however, and these have only been attacked spasmodically. The syndicates and companies formed to prospect the gold, copper, tin, graphite, asbestos, and mica occurrences rarely seem to possess sufficient strength to carry operations to a successful issue. To what extent natural conditions are at fault, it is generally difficult to determine. The Natal Government has therefore done a wise thing in securing the services of F. H. Hatch to report on the mineral resources of the country. Dr. Hatch was similarly employed as mining specialist in 1901 by the Government of India. His acquaintance with South Africa dates back for about 12 years, during which time he has contributed abundantly to geological and mining literature on local questions. A nine month's term of investigation in Natal is suggested, and, if he is provided with ample assistance, his report at the end of this time should cover all known mineral occurrences of importance.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

A ton of silver will occupy a cube 17¼ inches each way, while a 14¼ inch cube is the size of a ton of pure gold. This latter would be worth $602,861.

Tincture of larkspur, or a fluid extract, diluted with alcohol or Florida water, is a good wash for protection against the insects that infest Indians and Eskimo.

Silver amalgam may be made readily by electrolysis, using a solution of potassium cyanide as the electrolyte, a bath of mercury as the cathode, and silver bar as the anode.

An owner of a quartz claim by virtue of valid location can prevent trespass thereon. Prospecting for gold-gravel on such validly located quartz-claim would of course constitute trespass, against which the ordinary remedy of the law would apply.

Fuel and supplies for mines in the Rocky Mountains are hauled during summer for the winter campaign. In Alaska the hauling of supplies is done during the winter, when the ground is hard; thus preparations for summer work are made while the sledding is good.

Graphite prepared and ready for market is worth about one cent per pound on either the Atlantic or Pacific Coast. The deposits in Alaska are expected to dominate the graphite market of the world. It is a remarkably pure crystalline variety, existing in immense deposits, unmixed with gangue.

Gross royalty would be a payment at a fixed rate per ton of ore produced, or on a sliding scale dependent upon gross assay value. Net royalty would be a payment at a fixed rate per unit of metal paid for by the ore-buyer, smelter, or refiner. The terms have no hard and fast meanings, but depend materially upon the provisions of the contract.

Bronze is not adapted for bearing purposes because it is an alloy consisting of a hard eutectic in which the free grains of softer metal are embedded. The ideal condition for an anti-friction metal is precisely the reverse of this, namely, a soft eutectic in which the embedded grains are harder than the matrix. For the above reason bronze bearings are liable to run hot.

Copper is found in so many different kinds of rocks that it cannot be said to have any limitations in regard to rock-association. In a general way it is true that the more basic rocks usually contain the most copper, and that concentration of that metal into veins is most likely to occur in the vicinity of such rocks, of which the gabbros, pyroxenites, and many andesites are good examples.

Tamping of dynamite charges with clay and with sand was recently tested in South Africa by a Government Commission to ascertain what advantages, if any, might result in securing more perfect combustion of the explosive, so as to yield less of the poisonous carbon monoxide. It was also desired to see whether clay tamping would develop more energy from the explosive. The report states that the expected improvements were not found.

Bornite, or 'horseflesh' copper ore, is usually a secondary mineral, resulting from the reduction of solutions of copper sulphate by iron pyrite, or the copper-iron pyrite (chalcopyrite). The existence of bornite as a primary copper mineral is doubtful. The depth to which it may occur in the earth depends on the depth to which waters leaching the upper oxidizing portion of a vein may penetrate. It will not extend to a great depth below permanent groundwater. Bornite has been found deeper than 2500 ft. below the surface. It is a question of local conditions entirely.

Ochre, which is a highly aluminous admixture of various ferric hydrates, is worth from $15 to $25 per ton, ground and bolted, delivered at tide-water. The lighter yellows and reds are preferred to the deeper tints. Freedom from grit is one of the important points. To a certain extent this is removable by grinding and floating off, in the same manner as washing clays. After drying and pulverizing the pigment must be sifted through bolting cloth to prepare it for market. Sulphur and lime cause deterioration, and hence are objectionable. Mica is also undesirable.

Electric copper smelting has been done on a large experimental scale in France, under the direction of M. Vattier. The process is one of simple direct concentration of the copper out of the ore by fusion, ores from Chile averaging 7% copper having yielded a matte of 45% at a cost of $15 per ton of copper produced. The slags are said to have been quite clean, but that of course depends to a considerable extent upon the type of slag produced. The making of easily fluxing mixtures can not be ignored. The process is said to offer great possibilities, and will soon be tried on a working scale in Chile.

Tantalum, which is in demand for making certain grades of high-speed self-hardening steel, is obtained chiefly from the minerals tantalite and samarskite. The former is found as opaque, lustrous, irridescent, black crystals, which yield a dark-red to black streak on porcelain. The amount of tantalic oxide in the mineral varies within wide limits, the minimum being 3% and the maximum 65. Samarskite is generally massive, though sometimes found in flat embedded grains. Its lustre is vitreous to resinous, and the color velvet-black, yielding a dark, reddish brown streak. Both minerals occur in granitic rocks, having a similar habit to tin ore (cassiterite), with which they are often associated. The surest test for tantalum is to fuse in a platinum spoon with potassium bisulphate, and dissolve in dilute hydrochloric acid, when a yellow solution will result, while a white precipitate is thrown down; addition of metallic zinc to the solution produces a blue color, which disappears on dilution with water.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Goldfield Consolidated.

The Editor:

Sir—My attention has been drawn to an editorial in your issue of March 27, 1909, wherein you refer to the published accounts of the discovery of a new orebody in the Combination No. 1 ground of The Goldfield Consolidated Mines Co., and particularly to the following sentence: "It is surprising that the information should be given weeks after the event, at the close of a period during which bear tips have been circulated."

Under ordinary circumstances I should consider it unnecessary and undesirable to enter into argument with the editor of a mining journal, on mining subjects, especially with a gentleman whose eminence in mining discussion is as pronounced as your own; for mining engineers are undoubtedly entitled to their own notions on mining subjects, and the public is at liberty, and doubtless capable, of estimating the relative value of their opinions. But in the present instance your article transcends the scope of opinion to which a mining engineer, by reason of his perspicacity, is entitled, and contains an imputation of dishonorable procedure not only in connection with my administration of the affairs of the company, but of the attitude of its directorate toward the public, calling for elucidation and correction.

You will please take note of the fact that it is my custom, as general manager of this company, to supply its board of directors monthly statements of operation, and of the further fact that it is the practice of the directors, at the commencement of each year, to furnish stockholders and the public an annual report likewise showing the operations of the company. In pursuance of this policy, on December 23, 1908, reporting operations for the month of November, 1908, I indulged in the following language: "Combination. * * * On the 4th level good ore has recently been uncovered between the Combination and the January workings, and north of the drift connecting these workings. This portion of the Combination ground has never been developed, and present indications point to the possibility that continuous ore may be traced from the Combination to the January. There are no workings between the point where this ore was found and the surface; neither is this territory undercut in any workings below. We will proceed at once to cross-cut both above and below for this orebody."

On January 22, 1909, reporting for the month of December, 1908, I indulged in the following reference:

"Combination. Company development work on the Combination consisted of 676 ft. Development work has been extended in the vicinity of the point on the 4th level where rich ore was reported last month. A drift shows ore 6 ft. or more wide averaging about $100 per ton for a length of 60 ft., after which values became low. The continuation of this drift was later turned to the north, and high-grade ore was again encountered in the face. This strengthens our belief that continuous good ore will be opened up for a considerable distance in this heretofore unexplored portion of the property. This same ore-shoot has been found on the 5th level, and is being opened up. Also a cross-cut has just been started on the second level to cut the same orebody above."

On February 17, 1909, reporting for the month of January, 1909, I indulged in the following language:

"Combination. * * * On the 4th level stoping has been commenced on the new rich orebody north of the old workings, and high values shown by development work hold out well. This orebody has been recently cut on the 5th level, and is proving as rich as on the level above. We are also driving on the 2nd and 6th levels for this same orebody, and indications are very promising at both points. The stopes from the 2nd to the 5th levels, between the central Combination workings and the Riley, have been producing ore of better grade than formerly."

Now, will you please particularly note that in my annual report, which was mailed to stockholders in the latter part of January, 1909, and also given to the public, appears the following language, on page 22: "Very recently rich ore has been discovered on the 230 level north and west of the older workings. A drift on this vein shows an orebody 6 ft. in width, and already exposed 60 ft. in length, which averages higher than $100 per ton. Developments are not yet sufficient to determine the full size of this orebody, but it appears that this portion of the property, and the large area lying between it and the Mohawk workings, in which good ore was formerly unknown, may be very profitable. Recent developments in the Combination show that this property will compare favorably in production with the Mohawk."

The disagreeable, if not malicious, character of your editorial is emphasized by the fact that you had full knowledge, at least, of my public utterances on this subject as they appeared in the company's annual report, since you saw fit to comment editorially at great length thereupon in a recent issue of your journal, to which I deemed it quite unnecessary to reply, for the reason above stated, namely, that I was quite content to allow my opinions with respect to the possibilities of development of our property to stand before the world in contrast with yours.

There is another phase of this situation to which I desire to invite your attention. You will readily recall that I left Goldfield during the latter days of February and did not return until the afternoon of the 14th of March, and you will probably remember that between the 9th and the 11th of March I had the pleasure of an extended conversation with you in San Francisco, during the course of which I informed you that advices from Goldfield had revealed to me the fact that our mill-heads had run up to $100 per ton during my absence; that I could not definitely determine the real cause of this condition until

I had returned to Goldfield and made personal investigation, but that I believed it was due to the ore from this new Combination working. When I arrived back in Goldfield on the 14th, I made a verification of the assays and other necessary investigations, and on the evening of the 16th I sent a telegram in the following language to the directors of this company, all of whom were absent from Goldfield excepting myself, and most of whom were in the Far East:

"Combination new orebody is proving a bonanza. Last 14 days produced $300,000. Average everything extracted to date $190 per ton. Reasonable estimate ore opened up $4,000,000. How much more cannot be estimated without more development. Centre streak assays in the thousands and will be difficult to treat locally. May have to ship some to smelters. Orebody on two levels and 30 ft. wide in places. All directors notified."

This telegram, as I say, was sent on the evening of the 16th, and was received by the directors of this company on the morning of the 17th. On that same morning the secretary of this company issued and gave to the local press an official public statement, and the same appeared in the afternoon papers of that day; so that rather than the information having been "given weeks after the event, at the close of a period during which bear tips have been circulated," it was continuously referred to in the company's reports, and finally reached the directors and the public simultaneously, the directors even having no advantage in respect to knowledge of the final developments over the public itself.

To the undersigned, your editorial appears to be unnecessarily misleading (because you had read our annual report), and mendacious to a degree bordering upon personal affront. For this reason I have departed from my customary practice of ignoring editorial comments, and have cited to you facts which you already knew. I did not reply to your editorial criticisms of our annual report, because I felt that the report was of a character that needed no defense; but I may say in passing that this view is, in my judgment, abundantly justified by the fact that of all the comments I have seen upon the report, both in public prints and a large number of letters received in my office, yours was the only one not of a highly complimentary character. I ask, now, that you shall permit this letter to appear in the columns of your next issue, failing which I shall exercise the right to give it publicity otherwise.

J. H. Mackenzie,
Goldfield, March 29. General Manager.

[This letter would have appeared in our last issue but for the fact that this part of the paper goes to press on Mondays. No reflection upon the manager of the mine was intended nor was it suggested that he failed to inform his directors concerning the results of operations underground. Our comment referred to the inadequate information given to shareholders. Concerning this we have something to say on the editorial page. It remains only to point out that Mr. Mackenzie is incorrect in his use of the word 'malicious'. By reference to a dictionary he will find that 'malice' involves evil intention. As Mr. Mackenzie knows us personally, he will, we feel sure, on second thought, absolve us from such a charge.—Editor.]

Mechanical Elevator.

The Editor:

Sir—In your issue of February 20 and with reference to the report of S. R. Guggenheim, president of the Yukon Gold Co., quoting in part: "Three mechanical elevators were installed, two of which were put into operation during the season of 1908. It is a great pleasure to say that the mechanical elevators, electrically driven, which were designed by our own engineers, and *used here for the first time* in any country, were entirely successful." Mr. Guggenheim is probably not aware of the fact, that this class of elevator was installed at Barkerville, Cariboo district, British Columbia, some eight years ago; this having a daily capacity of 2000 cu. yd. and elevating vertically 110 ft. The efficiency and economy of this class of elevator has long been proved.

J. Wendle.

Barkerville, B. C., March 16.

[The first mechanical elevator ever designed was designed by Henry Bryant to work a flat claim in lieu of a hydraulic elevator on Prichard creek, near Murray, Idaho. This was in 1900. The next one was a copy of Bryant's and was made by the Stearns, Roger Manufacturing Co. of Denver, as adapted by George H. Evans for the Gold Pan Mining Co., at Breckenridge, Colorado.—Editor.]

The Engineer as a Financier.

The Editor:

Sir—In the discussion of the Mining & Metallurgical Society which you published some time ago, Mr. Merrill said that a large number of promoters did not know or care what they were selling, and he goes on to say that " in the small minority of cases he is honest." Is not that rather hard on the promoters? Is there any specific reason why he should be more dishonest than his fellow man in the business world? There might be something in it when he has to draw on his imagination at times to answer questions that the buyer thinks of vital importance. Again, he might enlarge on the advantages of the proposition to lure the prospective buyer, for it takes great inducement to make the average man buy mining stock. How much would be sold if the people were informed that their stock would bring 12½% yearly? Not very much! Give to the man who makes mining his business, the details of a proposition, and if he sees a reasonable compensation he will become interested, and if what you say is confirmed he buys. But not so with a layman; you have to picture to him wealth beyond the wildest dreams of avarice, and remove all doubt of failure, to make him take a thousand dollars' worth of stock.

As to the statement that the promoter does not care what he sells or what the deal is, let Mr. Merrill take some proposition on the street anywhere in the country and try to sell it. If it be not full of merit, or if it has a tinge of the 'wild-cat' in it, see

how readily he is told that the organizer does not care to handle properties of that class. If the promoter sells something that brings the purchaser a remuneration, he can go back and sell to him again, and also to his friends, but if it doesn't 'make good' he can't even sell to his friends' friends. I will let the reader judge whether the promoter cares what he sells or not.

The reason so many mining deals fail is not because of dishonesty on the part of the organizer, but on the part of the engineer that makes the report. How many times have we, as engineers, been asked to make a report by some mine-owner, with the understanding that if the sale is made as the result of our report we will be at the melon-cutting. With this Hays Hammond idea in his head it is easy for the engineer to deceive himself to the extent that the vein averages 6 ft. wide, when it is really only 3 ft., and that the values are $40 per ton, in place of $15. The report goes to the broker's office, it looks good, in fact very good; he sends down an engineer to re-examine. This engineer goes and stays a couple of weeks with the owner, who treats him like a king, and *he* gets Hammondized. What happens to the promoter; well, you all know what a reputation they have. I will make the assertion that there are not more than one out of ten mines that I examine that will come up to the statement in the original report, and it takes a well made, fully detailed, and honest-looking paper to get me out of my office.

TOM L. GIBSON.

St. Louis, March 24.

Uses of Aluminum.

The Editor:

Sir—The interesting article on aluminum, appearing in your issue of March 20, coupled with the fact that the price of the metal is to be greatly reduced before the end of this year, has suggested still another use for it. I refer to the use of aluminum as a precipitant for gold and silver from cyanide solutions, in place of zinc. The aluminum could be used in the form of shavings in ordinary zinc-boxes, or as powder in connection with Merrill's precipitation presses.

In 1893 Moldenhauer proposed the use of aluminum for this purpose, and the following equation may be taken as representing the reaction in presence of free alkali:

$$6KAu(CN)_2 + 6KOH + 2Al = 6Au + 12KCN + 3H_2O + Al_2O_3.$$

This method of precipitation is referred to in Julian & Smart's 'Cyaniding of Gold and Silver Ores', page 158, where it is stated that experiments were made on a large scale by Julian in the Rand Central Ore Reduction Co.'s works, and it was found that the accumulation of alumina in the solution proved extremely troublesome. The high price of aluminum at that time also doubtless had an influence against its adoption as a precipitant.

It seems probable that if the alkalinity of the solution is not allowed to become excessive, alumina cannot accumulate in it, and as a precipitate would give no more trouble than the insoluble compounds of zinc which are formed in the zinc-box. As 54 parts of aluminum are equivalent to 195.9 parts of zinc in reducing power, therefore one pound of aluminum will do the same work as 3.6 pounds of zinc. Taking the price of sheet zinc at the factory as 6.25 cents per pound, it is evident that the price of aluminum would have to be 22.5 cents per pound to be equivalent to the zinc, with the advantage in favor of the aluminum of the saving of two-thirds in freight cost. In a large plant this reduction of over two-thirds of the weight of precipitant which has to be shipped to the plant would mean an economy worth considering.

Owing to the ease with which zinc compounds are reduced to metal in the crucible, the refining of zinc-gold-slime is troublesome and expensive. As alumina cannot be reduced to metal during the smelting of the precipitate, finer bullion can be produced at a smaller cost, and some losses of the precious metals avoided.

The fact that aluminum cyanide does not exist in aqueous solution would lead one to expect a reduced cyanide consumption when aluminum is the precipitant. In the case of the precipitation of the gold this saving will not be appreciable commercially, but if the solution contains copper or other base metal which is precipitated by the aluminum, this regeneration of cyanide may prove worth considering. Roughly speaking, the precipitation of one pound of copper from solution will regenerate two pounds of cyanide. Sodium, which is a deleterious impurity in aluminum when used for other purposes, would in this case be a help. Possibly an alloy containing two or three per cent of sodium would work better than pure aluminum, and would cost less to make.

During the last few years no attention appears to have been paid to the use of aluminum as a precipitant, but when the price of the metal goes down to 13 cents or less per pound, the theoretical advantages of its use will make its application worth the attention of cyaniders to overcome any difficulties in practical work.

BERTRAM HUNT.

San Francisco, March 25.

Tailing-Wheel v. Pump.

The Editor:

Sir—I would suggest the use of a jet-elevator similar to the Evans hydraulic-elevator used for elevating placer-gravel or to some form of conveying device. To avoid friction, the discharge-pipe should be vertical and should be made of manganese steel. The tailing should be de-watered by running through a Callow settling-tank or some similar device. The water should be run through turbine pumps to give it the required pressure to act as a jet, and then be conveyed by pipe to the bottom of the elevator, where it would meet the sand. Acting on the sand through the nozzle, it would elevate the whole mixture to the top of the elevator stand-pipe, whence it would run by gravity to the dump.

HIRAM W. HIXON.

Florence, Italy, March 13.

THE UTAH COPPER MINE.

Written for the MINING AND SCIENTIFIC PRESS
By COURTENAY DE KALB.

Commercial ore at the mines of the Utah Copper Co. in Bingham canyon is assumed to embrace that which will yield a gross return of $2.60 per ton. This conclusion is reached from the official statement that the enterprise would be profitable upon ore having an average copper content of 1.5%, a precious metal content of 0.15 oz. silver and 0.015 oz. gold per ton, a recovery of 63%, and a selling price at New York of 12½c. for the copper. The silver is estimated at 50c. per oz., the gold at $20.67, the precious metal contribution to the total being therefore 24c., which is an important proportion. The mining costs are reported to be 40c. per ton; transportation of the ore to mill and of concentrate to smelter will figure an average of approximately 30c. per ton. Accordingly a margin of $1.90 remains, out of which to pay costs of milling, smelting the concentrate to blister copper, shipment of 'blister' to Atlantic sea-board refineries, refining, and marketing, the use of plant, amortization, and to yield a profit. The Utah Copper Co. expects to make copper at a cost of 7½ to 8c. per pound. In the third quarter of 1908 the production of slightly over 12,000,000 lb. was said to be made at a total cost of 8.73c.; in the second quarter of 1908 a similar production cost 8.16c. This is upon a higher recovery than 63%. So satisfactory a result could not be reached were a loss of 37% in handling, concentration, and metallurgical treatment, actually sustained. The ore being utilized at present averages approximately 1.8% copper, and the recovery, according to trustworthy information, is 70%. That alters the figures to 25 lb. copper obtained, worth $3.12 at 12½c. per pound. On the same ratio of recovery the precious metals would add 28 cents. The total gross return on this basis is $3.40. Based upon the higher cost of 8.73c. per pound, the outlay per ton of ore would be $2.18. The apparent profit for the copper alone is 94c., which the precious metals would increase to about $1.22. The cost of mining and transportation being assumed at 70c., there would remain $1.48 applicable to milling, smelting, and marketing. The figure of 40c. for mining is said to take account of the proportionate charge per ton for removal of overburden. The ore is mined partly by caving, and partly by steam-shovel. A semi-official statement places the cost of steam-shovel mining at 20c. per ton, by which method 75% of the output is obtained; the ore yielded by the caving system is reported to cost 65c. per ton delivered in the mine-bins. If these results are achieved, 40c. would easily cover the cost of mining, inclusive of fixed charges. Scrutiny of these figures will show that high efficiency and rigid economy are demanded in every detail of operation. An effective answer to criticism is that the methods employed were tested by preliminary work of several years' duration. The company demonstrated the possibility of insuring a profit at the low figures of recovery and price above stated, before venturing the enormous outlay for plant and equipment that now places the Utah Copper Co. among the notable metal producers of America. It is to be noted that final calculations were founded on results obtained from ore broken mainly in the course of development. Mining on an economical scale was not started until June 1907, the experimental mill at Copperton, in Bingham canyon, being fed by ore derived from development and cave-mining.

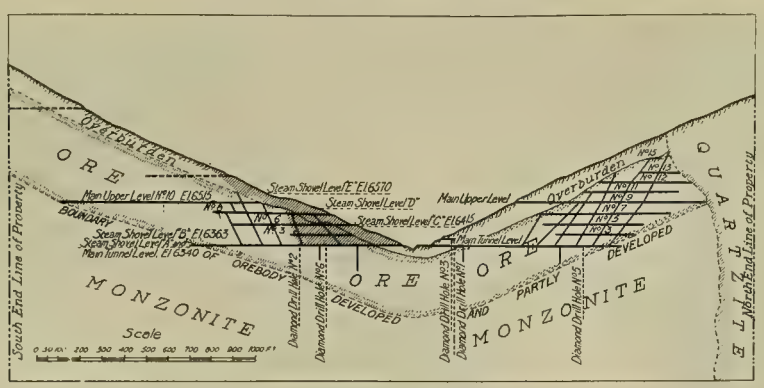
The Utah Copper Co.'s mine is an example of the class of large low-grade deposit, admitting of definite measurement of enormous masses of ore, on which the largest recent copper projects in America have been based. No uncertainty exists in regard to quantity and metallic content. Having eliminated the mine-risk, the remainder of the problem relates to mechanical details of production, with a forecast of minimum market price. The orebody is of the same type as the deposit now being worked by the Nevada Consolidated Copper Co. at Ely. A mass of monzonite exposed on the surface, containing disseminated chalcopyrite, has been superficially leached, resulting in a zone of secondary enrichment below, diminishing in copper content with depth. Thus three concentric zones exist; the overburden, averaging 70 ft. in thickness, containing about 1% copper, mainly present as carbonate; a zone of secondary enrichment averaging 1.8 to 2% copper through a thickness of 310 ft., and a lower zone of undetermined thickness containing 1.5% copper and lower. A striking difference is observed, however, between the disseminated ore of the Nevada and of the Utah monzonite. At Ely a true primary ore is found, the chalcopyrite and pyrite being disseminated through the igneous mass in the form of minute crystals intergrown with the crystals of the original rock; at Bingham the chalcopyrite is present extensively in the form of thin scales and films through a multitude of minute parting-planes and also disseminated perhaps equally as grains. The evidence points to the introduction of copper subsequent to the consolidation of the monzonite. The quite uniform distribution of the metal is remarkable in view of this fact. Zones of greater crushing, silicification, and alteration, however, yield copper in larger amount. These are mainly around the periphery of the intrusive monzonite. In general the character of the monzonite in these two widely separated localities is similar, but the Nevada rock is more highly silicious, the respective amounts of silica being 61.7 and 57.9%. Both are fine-grained, and contain much hornblende with the feldspars, which latter consist largely of orthoclase in both instances. Quartz is nearly absent as an original mineral, and as an alteration product is much more prominent at Bingham than at Ely. In both places the tendency of the outcropping monzonite is to form a depressed surface of even slope, but the exposure in Bingham canyon is the more remarkable in this respect. The peculiarity of outcrop is due, of course, to the greater decomposition of the monzonite than of the surrounding rocks. The superficial extent of the deposit can be seen at a glance by the abrupt change from the flowing slopes of the monzonite area to the jagged outcrops of the enclosing quartzite. The mineralized porphyry

which has been explored, underlies 80 acres; this has been developed sufficiently to admit of an estimate of 1,000,000 tons of ore per acre. Twenty acres have been fully developed, and sixty more have been extensively tested by drifting and boring. While ores containing 1.5% copper or even less are commercially profitable, the 20,000,000 tons of proved ore will average higher than 1.8%. The total area of mineralized monzonite within the limits of the property is 160 acres, and the belt extends into the ground of the Boston Consolidated Copper Co. to the southwest. Bingham creek flows in a deep ravine northwestwardly across the area to be mined. The slope of the canyon on either side is 40% near the base, gradually steepening to 45% near the upper portion of the monzonite. A cross-section shows approximately 1400 ft. of ore on the northeast, and 1850 on the opposite side which lies contiguous to the Boston Consolidated; but it must be remembered that the secondary enrichment has produced a zone of workable ore concentric with the slope, so that the dividing plane between the two properties, in workable ground, will not be more than about 340 ft. high.

Coming back from this digression it appears that the mining problem presented is that of excavating a mass on two sides of a creek, having an overburden 70 ft. thick, below which lies 310 ft. of valuable ore. Adits driven each way from creek-level pass into ore of lower grade than 1.5% copper, at a distance of about 900 ft. from the portal. Beyond the adits the ore, following the surface-angle, extends 500 ft. on the northeast from what is called the East Tunnel level, and 1000 ft. up the slope from the end of the Main Tunnel level on the southwest side. The property consequently is divided into two nearly equal portions, one constituting ore available above and upstream from the present levels, and the other lying



Map of Utah Copper Company's Property.



Section on AB of Map.

below and down-stream, which will be mined in the distant future. A simpler situation for economical mining would be hard to duplicate. From either side the ground can be worked back in a series of terraces, by steam-shovel, and the slopes are not so steep as to occasion an excessive prolongation of track-mileage to serve the different terraces by a switch-back railroad system. This system comprises 13 miles of track. The maximum grade of the road is 4.6%, and it climbs the mountain sides in 9 laps to a height of 400 ft. above the main loading-bins at the mine-mouth. The locomotives used weigh 50 tons, and two are required to take a train of 10 empty six cubic yard cars up the grades. The overburden is handled in six-yard dump-cars over stripping tracks, constructed on a level. One locomotive can easily haul trains of 20 loaded dump-cars over these level stripping-tracks to the waste-dumps in gulches on adjoining properties where space has been purchased for that purpose.

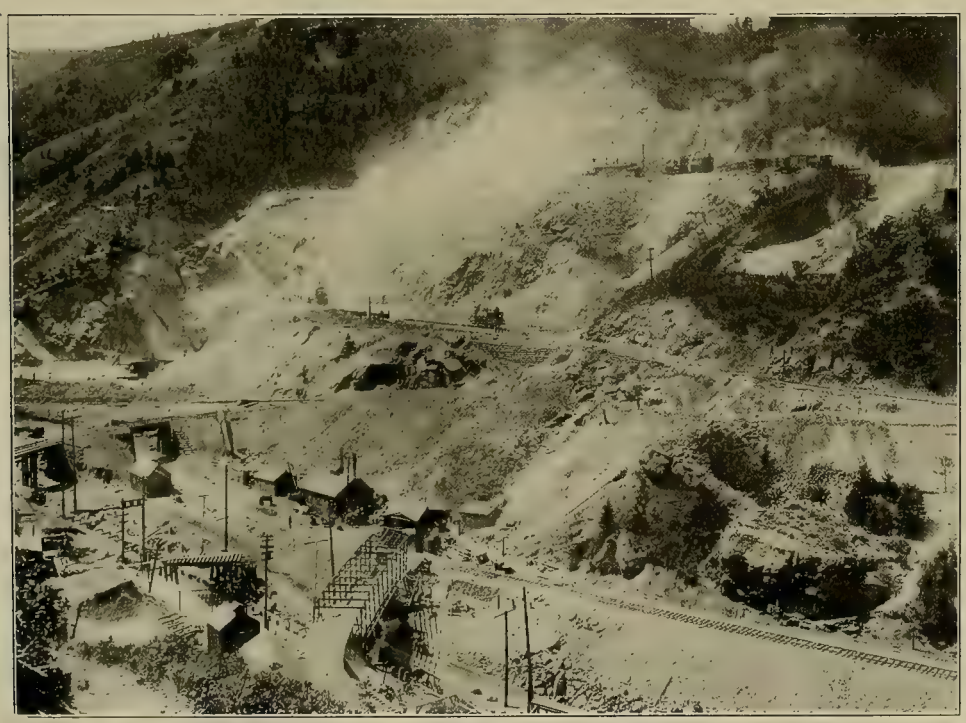
In order to prepare the ground for steam-shovel excavation two methods are available; one is to strip the overburden by steam-shovel after 'springing' and blasting the bank with deep shots in holes bored by Keystone drills ahead of excavation, as is done at Ely, and the other is to undermine it by caving, which is the present practice of the Utah Copper Co. to a limited extent. It is claimed to be somewhat cheaper per ton to undermine than to 'shoot' and excavate under certain conditions. The calculation takes into account the reduction in the number of terraces which occurs from having previously brought down the upper portion of the orebody, and the consequent extra mileage of railroad needed, with transportation costs during the process of stripping. Three laps of railroad, corresponding to an elevation of 325 ft., which would have been needed to reach the benches in stripping by steam-shovel, are thus saved. The problem is too complicated to suggest probabilities of comparative cost of the two methods after no more than a superficial inspection. If the ore won by caving actually costs only 65c. per ton the statement would seem to be fully credible, but the costs of caving as conducted in the Utah Copper mine must be quite variable. A large amount of ore would have to be mined more cheaply than 65c. to strike the average claimed, namely, 40c., since a great deal of it certainly costs as much as $1.25, or more, per ton. The introduction of the steam-shovel was determined upon after the orebody had been extensively developed for cave-mining. A large initial expenditure in adits, drifts, and raises was made before the adaptability of mechanical excavation was demonstrated. It is now shown that the caving system results in no financial advantage over the alternative method of stripping, even so far as the present workings extend, and it is being rapidly abandoned.

The caving system as adapted to the Utah Copper mine is not a direct application of the methods followed in the Lake Superior iron region. Two principal adits or tunnel-levels were driven from the surface, penetrating the orebody to the limit of 'commercial ore.' From these levels drifts, or galleries, are run in both directions, and connected by cross-cuts. Between the lower and upper main-levels intermediate levels are driven, and likewise the ground above the upper level is dissected by sub-levels, drifts, and cross-cuts. The vertical distance between the main-levels is 200 ft., and from the upper main-level to the surface at the highest point is nearly 350 ft. The intermediate levels were originally spaced 17 ft. apart vertically, but the distance between later levels was gradually increased to 25, then to 33 ft., and in future the distance will be 50 ft., thus materially raising the ratio between the tonnage of ore removed by blasting and by caving, with the intention of correspondingly reducing the cost. From the lower gridiron of drifts and cross-cuts 14 raises were extended up to the overburden, serving for ore-chutes in an area approximately 800 by 500 ft., making an average of one main raise to a block of 70 ft. square on the lower level of the mine. The mine is not laid out so systematically as this would seem to imply. The raises all incline toward the outer edge of the orebody at angles varying from 50 to 60°. Within each prism penetrated by a raise, branch raises are driven near the capping or overburden, and from the principal branches sub-branches are in turn driven as the workings come nearer to the overburden. Thus the system of raises assumes the shape of a leaning tree, branching out against the capping of oxidized low-grade rock. The weakening of the ground becomes progressively greater toward the surface, and the pressure crushes the skeleton of pillars. The whole mass settles quite evenly, bringing the overburden down in a body which alternately fractures itself and re-consolidates under pressure. The number of these branches is such that on the level where caving is to be effected one such opening into the system of raises exists for every 12 by 12 ft. of horizontal cross-section, the sub-raises being 5 by 5 ft. From this the ratio of ore blasted to ore caved would be 1 to 5.76, but unfortunately so favorable a ratio cannot be attained. Although the ground thus weakened sometimes starts to crush without further assistance, and occasionally comes with undesirable celerity because of 'slips' which have been formed in the process of alteration which has taken place throughout the rock, the regular practice is to widen each raise on the sub-level immediately below the overburden, giving it a funnel shape. Thus the pillars are narrow at their bases, and spread out overhead after the manner of groined arches. If this does not produce signs of movement in the superincumbent mass the roof is further weakened by over-hand stoping. Finally the collapse is hastened when necessary, by shooting down a number of pillars.

In order to further elucidate the method of honeycombing by branched raises the accompanying illustrations have been prepared. They are not taken from the mine map, but are from freehand sketches, representing the system in principle. In Fig. 1 is shown an ideal section with levels, intermediates, main-raises, branches, and sub-branches. The workings extend through the ore to the overburden. In the figure the branching of raises, with their funnel-



Steam-Shovel Mining, Utah Copper Mine.



Switch-Back Railroad, Utah Copper Mine

shaped upper termini are depicted, together with the arch-stoping. It will be seen from these that great pressure is thrown upon pillars of narrow base. An important point in controlling the movement and the crushing of the ore is to prepare a sufficient area for caving. This necessitates concentration of mining operations in a limited area so that it may be uniformly 'honey-combed'. The result is economical, but it would appear to possess the disadvantage of risk of sudden collapse. The management states, however, that such is not the case. The total area which is undermined is large, but the avenues for retreat are numerous. The method certainly does not admit of control of caving so as to confine it to definite boundaries. This is one serious criticism to which it lies open.

After an area has been caved the crushed ore is drawn off through the raises from below until the barren overburden appears. Drawing is then stopped until the ground between that level and the next intermediate level below has been similarly honey-combed and caved. The overburden so far consolidates after each caving as to follow the ore as a blanket, without mixing with it, and large areas which have broken and settled are observable on the surface. The cost of driving the levels and raises is about $2.50 per running foot for an average cross-section of 6 by 6 ft. The actual ratio of ore won by blasting and by caving is approximately 1 to 3. The total length of underground workings is nearly 24 miles. Timber is used only for keeping open the main gangways where the ground is weak, and for building chutes. The total timber expense is only a fraction of a cent per ton of ore mined. Tramming is done by hand on all but the lower main-level. Electrically operated trains of double side-dump cars, having a capacity of 48 cu. ft., convey the ore on a 24-in. gauge track from the bottom of the main raises to the loading bins in the canyon, whence it is shipped by standard gauge railroad to the mills at Copperton and Garfield. The daily output from the mine, exclusive of the ore excavated by steam-shovel, is 1500 tons. The mine-tramway branches into four tracks above the bin which has a total capacity of 6000 tons. The elevation of this tramway is 6340 ft. above sea-level.

Cave-mining prepared the area which is now being excavated by steam-shovel on the southwest side of Bingham creek. The upper portion of the orebody, however, was not reached. This is equivalent to saying that the adaptation of caving to the preparation of the ground for subsequent mechanical excavation was not done at this point in the systematic manner with which it is being applied in the direction of the northeast boundary. The reason it is being done at the northeast boundary of the orebody is because there is in that portion a high isolated body of ore which it is best to mine by caving, thus dropping the overburden down to an elevation where it can be handled over one of the present stripping-tracks. The overburden which had been loosened and crushed by caving, where shovel-work is now in progress, has been nearly stripped, and the customary methods will have to be applied to the higher and more difficultly accessible portion of the deposit. The stripped overburden is stored in the canyon above the copper-bearing area, and will be cheaply accessible if, in future, leaching of this low-grade carbonate ore can be done at a sufficiently low cost. If the production of large quantities of sulphuric acid from fume be necessitated as a condition for the continuance of the smelting industry in the Salt Lake valley, this overburden may constitute a convenient means for consuming a fraction of it. The company owns eight steam-shovels, of which seven are of the Marion model, and one a Vulcan. A 65-ton Bucyrus shovel has just been ordered. Only two shovels are continuously employed on ore, one other being used part of the time for loading ore and part of the time on overburden. Three 95 and two 65-ton Marion shovels are stripping overburden. The usual crew, consisting of shovelman, craneman, fireman, and six pit-men, are employed with each steam-shovel. The output per shovel is about 600 cu. yd. per shift of 10 hr., and the coal consumption will average about 2½ tons per diem for each machine. Water for the boilers is piped 2 miles. It is free from scale-making salts, having been used on 18 month campaigns without trouble. The results of operation have shown that 90% of possible shovel-time has been productive, only 10% being lost for maintenance and repairs.

The great pit in which mining is being conducted starts near the creek on the 6340-ft. contour. The area stripped is 15 acres, nearly 0.8 of an acre being laid bare per month, equivalent to 87,000 cu. yd. The work of mining the ore with steam-shovels is advancing entirely on the bottom level, the upper bench being merely the top of the ore, with a 60-ft. wall of overburden beyond, on which the stripping-shovels are working. The experiment of reducing costs by avoidance of terracing has been carried to the extent of working with steam-shovels against a wall of ore 220 ft. high (Fig. 2), and the endeavor will be made to mine the entire thickness of commercial ore in one bench, which would be 310 ft. high. The angle of the wall is about 55°, and it has stood the test of exposure to one winter season without sloughing. The face is shattered by heavy blasts, and afterward 'trimmed' by a gang of men, working with the aid of a rope, using bars to pry off and throw down the loosened masses. The ore thus forms a talus at the bottom of the artificial cliff, where it is available for the steam-shovel. Now and then an avalanche of ore tumbles upon a shovel and buries it out of sight, but the number of accidents has been very small in view of the peculiar risks which are taken. The ore 'stands' well, as may be judged from this; it is not 'blocky,' nor do many 'slips' occur. Such parting-planes are generally of large extent, are readily discernible, and the movement of large masses can be anticipated. Thus accidents are preventable in large degree.

The method known as 'bank-blasting,' familiar to all hydraulic miners, is employed for loosening the ground. It is locally, and not inappropriately, termed 'gophering.' Little adits, only 2 ft. square, are driven into the ore, perpendicular to the face, for a distance of 30 to 40 ft. At the end, drifts at right

angles extend in both directions, making an excavation in the form of a T (Fig. 3), the cross of the T being from 50 to 60 ft. in total length. In the cross are stowed from 30 to 60 kegs of FF powder, primed with three to four 30% dynamite cartridges, tamped with broken ore, and fired by an electric battery. One blast will loosen as much as 60,000 tons. The zone shaken by the blast 'tails out' 60 ft. on either side, that is, the shattering extends about 180 ft. horizontally, and 120 ft. in height. In selecting a site for a 'gopher-hole' the ore is examined carefully for

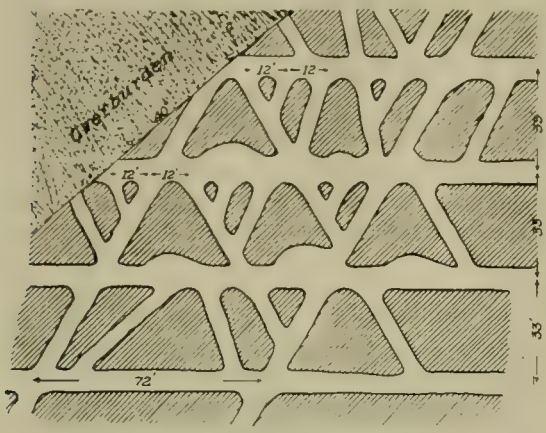


Fig 1. Caving System, Vertical Section

slips, as the blast is entirely ineffective across such planes of division. The ore falls in masses which are often of immense size. Therefore drilling and blasting are constantly in progress on the ore-pile at the base of the bench-wall.

The ore as mined in the open pit carries from 4 to 6% moisture. The bottom of the pit is exactly on the level of the ground-water. Above this horizon it is estimated that 60,000,000 tons of ore are avail-

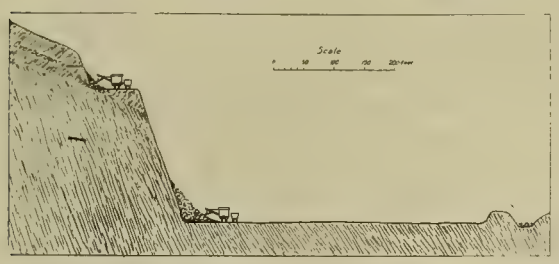


Fig. 2. Mining by Steam-Shovel.

able. At the present time the total output of ore is nearly 6000 tons per diem, of which a little less than 75% is won by steam-shovels, but the proportion is increasing, and in about two years all underground production from the Utah Copper Co.'s mine will cease. If steam-shovel mining can be maintained at a cost as low as 20c. per ton, as unofficially claimed by the management, it will be a remarkable achievement. The manager states, however, that the average costs for the past 18 months have been less than 20c. per ton, and that the work is being so improved as to reduce that figure to a still lower level. It may be accomplished when all is favorable, but it certainly allows for no contingencies, nor for increasing cost as the higher portions of the orebody are reached. But the company earned a net profit of nearly $500,000 in one quarter of 1908, with copper selling at 13c., which is near the basal price on which the enterprise was founded, and the cost of the ore in the shipping-bin was certainly not less than 40c. per ton. It is equally certain that the cost can be

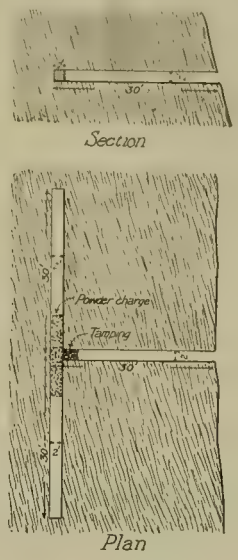


Fig. 3. Bank Blasting.

maintained below that figure when mining is conducted exclusively by steam-shovels. This great deposit of low-grade ore has been known for many years, but the development previously done was in the hope of finding zones of high enrichment. It required the gift of what is called today, in a semi-commercial sense, 'imagination,' to plan the utilization of a mass of ore which possessed a copper content no higher than 1.5%. To D. C. Jackling belongs the honor of seeing the possibilities, of convincing those who held the financial sinews for so gigantic an enterprise, and, in the light of results, the validity of his forecast stands unchallenged.

The comparatively thin but widely extended salt deposits of the world, such as the Silurian deposits of the New York-Ontario area, are the result of 'salt-pan' evaporation. Salt, however, is readily dissolved by water at ordinary temperatures. Cases where such brines have been evaporated and salt precipitated may be observed in nearly every part of the world. If, as in Hungary, the bed formed in the regular 'salt-pan' way, near enough to the surface to be mined, is folded, faulted, and traversed by thermal waters from volcanic vents, it may often require care and patience to distinguish between primary and secondary deposits. If, however, the 'salt-pan' salt is at a great depth, yet subjected to the dissolving power of artesian waters, such waters necessarily being hot at the depths postulated, then the resulting solutions, if saturated at such high temperatures, are obliged to part with their salts as the surface is approached. Growing crystalline masses result, and dome structure follows. Such occurrences are found at Petite Anse and other points in Louisiana.—*Economic Geology.*

DRY CHLORINATION OF SULPHIDE ORES.

By F. W. Traphagen.

*Any process that is sound in theory ought to be successfully put in commercial operation. It seems that this applies to the process of dry chlorination of sulphide ores, which is now attracting so much attention. The use of chlorine in one form or another is not new to metallurgy, and this element has been the means of adding many millions to the world's store of wealth, chiefly through its use in chloridizing roasting for pan-amalgamation, hyposulphite lixiviation, and in the vat and barrel-chlorination processes. The proposed new process, however, is totally different in principle from any of the above, for while they require air in the preliminary operation of roasting, it is indispensable to the success of the new process that oxidation be prevented and that the operation be carried on so that chlorides are the only products formed.

Reference to the accompanying table will show how important this point is; for it must be borne in mind that the tendency, when chemical changes are taking place, is for those compounds to form which in their combination produce the maximum heats of formation. Furthermore, when conditions, especially temperatures, are favorable, these tendencies are the more marked the greater the differences between the heats of formation of the existing compounds and of those which may be formed by the re-combination of the elements. Where the heat of formation of the possible new molecule is but slightly greater than that of the original molecule, the elements show but slight disposition to make new combinations, and the application of external energy is necessary to affect a change.

Keeping these points in mind, it is seen from an inspection of the data in the table that the heat of formation of zinc chloride, for example, is more than double that of its sulphide, while the oxide possesses a value almost equal to that of the chloride. In like manner, the heats of formation of the sulphides and chlorides of the other elements are respectively: silver, 3000 and 29,000; cuprous salts, 20,300 and 35,400; cupric salts, 10,100 and 51,400; lead, 20,200 and 83,900; ferrous salts, 24,000 and 82,220; manganous salts, 45,600 and 112,000.

In carrying out the process care is taken not to introduce an excess of chlorine, so that only the protochlorides are formed. More energy is developed, and the higher chlorides are formed when the partly chlorinated mass is discharged into water and treated with additional chlorine and steam. This brings all the metals into solution, when they are passed through filter-presses with wooden frames, and separated from the insoluble gangue and sulphur. The metals may then be successively precipitated by displacement: gold and silver by copper; copper by lead; and lead by zinc. The reduced iron and manganese chlorides are perchloridized by steam and chlorine gas, and precipitated by zinc oxide. The solution thus freed from all the metals save zinc, is evaporated to dryness and the resulting zinc chloride electrolyzed with the production of metallic zinc and the regeneration of the chlorine. Theoretically about 22 lb. of zinc should be produced per hp.-day; actual results have been somewhat better than half this figure, and with improved devices may be expected to reach as much as two-thirds of the theoretical figure.

The field of usefulness of this process is large, the most promising one being the treatment of those ores that have so long been a source of trouble, namely, the complex lead-zinc ores that could be marketed only by sacrificing one or other of the valuable constituents. The process is peculiarly adapted to the treatment of such ores, and much is expected of its development and success in that direction. Like many other processes, this is not new; and while Baker and Burwell, Swinburne and Ashcroft, and Alf. Sinding-Larson deserve credit for their part in its development, they were far from being pioneers in the use of dry chlorine gas with ores, patents having been issued for this purpose as early as 1868.

*Abstract of paper in the *Western Chemist & Metallurgist.*

HEATS OF FORMATION OF SULPHIDES, OXIDES, AND CHLORIDES.

(Adapted from Richards' Metallurgical Calculations.)

METAL.	—SULPHIDE—		——OXIDE——		———CHLORIDE———		
	Molecular Weight.	Heat of Formation.	Molecular Weight.	Heat of Formation.	Molecular Weight.	Heat of Formation. Dry.	Heat of Formation. In dil. sol.
Gold	....	.....	442.0	11500	303.5	22800	27200
Silver	248.0	3000	232.0	7000	143.5	29000	.....
Copper (ous)	159.2	20300	143.2	43800	99.0	35400	.....
Copper (ic)	95.6	10100	79.6	37700	134.6	51400	62500
Lead	239.0	20200	223.0	50800	278.0	83900	77900
Iron (ous)	88.0	24000	72.0	65700	127.0	82200	100100
Iron (ic)	....	.....	160.0	195600	162.5	96150	127850
Manganese (ous)	87.0	45600	71.0	90900	126.0	112000	128000
Manganese (ic)	....	.....	87.0	125300	....	.....	.....
Zinc	97.0	43000	81.0	84800	136.0	97400	113000

The heats of formation in the above table are given in gram-calories per gram-molecular-weight for each compound.

Water or any liquid kept in a wooden pail is apt to taste of the wood. To prevent this, says the *Practical Carpenter*, fill the pail with boiling-hot water and let stand until the water is cold; then empty the pail and wash the inside with a solution of soda in lukewarm water, with a little lime added.

METEOR CRATER.

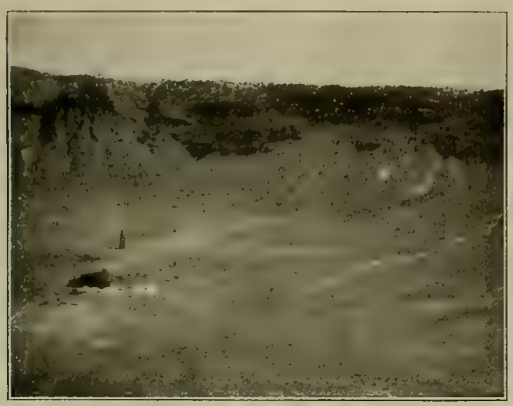
Written for the MINING AND SCIENTIFIC PRESS
By JOHN B. HASTINGS.

In Longitude 111° 1′ west, latitude 36° 2′ north, and five miles almost due south of Sunshine, a station on the Santa Fé railroad, in Coconino county, Arizona, is an interesting and now well known phenomenon called Meteor Crater (formerly Coon Butte). It has been visited and described by G. K. Gilbert, D. M. Barringer, B. C. Tighlman, G. P. Merrill, and H. L. Fairchild, and the following notes have been compiled from the writings of all these authors, except the report of Mr. Gilbert, which is unattainable.

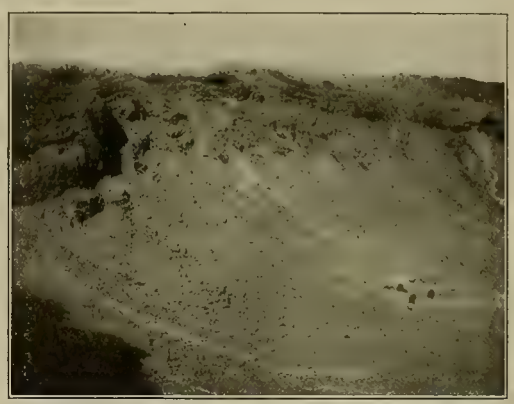
It may be said, however, that Mr. Gilbert deems the crater an ordinary volcanic butte, the result of a steam-explosion, even though there are no volcanic rocks in the vicinity. The other authors believe that the crater was formed by the impact of a meteorite, like a depression in an iron plate from a cannon ball. I was on the ground in the spring of 1907, but only for three hours—long enough to walk around the crater and have a talk with the mine superintendent. The shortness of the visit and my ignorance of literature on the subject, made my impresisons nearly valueless, but from casually examining many pieces of the silica, I thought it was the result of ascending hot waters, and that probably the pit was caused by the erosion of an underground stream, which, after its work in solfatarism, had carved for itself an outlet, and that the perpendicular circular walls resulted from a combination of faulting causing the uplift, and perpendicular jointing in harder beds underlaid by softer. I had not time to examine the nature of the material of the outer slopes. This conception I find has been considered and discarded by capable men.

The butte is circular, 3950 ft. diam. in a northerly line, and 3850 ft. from east to west; it is 120 to 160 ft. high above the level plain, and the crater or internal pit is 600 ft. deep. Before Meteor Crater was formed its site was probably occupied by a flat topped butte of considerable area, rising not over 30 ft. above the limestone plain, a remnant of a red sandstone bed of that thickness. The uppermost strata composing the butte dip quaquaversally 5 to 10° from the centre, this shallow dip being complicated by faulting, creating high local dips, from 60° to an overthrust. The geological column, from the surface downward consists of 30 ft. of red sandstone, then 200 to 350 ft. of yellowish-gray calcareous sandstone called the Aubrey limestone; then 800 to 900 ft. of light-gray, almost white, fine-grained sandstone; and under this a thin stratum of yellow sandstone, the thickness not definitely known. It seems, however, to be the uppermost member of the Red Beds, which the U. S. Geological Survey says are 1000 ft. thick. These sediments belong to the Grand Canyon series of the Carboniferous, and extend 70 miles in every direction, except where occasionally interrupted by volcanics, the nearest of which are 12 miles southeast.

The outside slopes of the butte are composed of red sandstone, Aubrey limestone, white sandstone, and a few yellow and brown sandstone fragments.



Meteor Crater.



Another View.

The limestone blocks range in size from 5000 tons, down to silica in microscopic fragments (pulverized sand grains). Many large fragments of the limestone have been hurled a mile from the centre of the crater, and others of 50 tons more than a mile. The greater number of the limestone boulders, up to 5000 tons, are on the slopes outside of the crater in an east and west line through centre. There is no order in the distribution of the fragments, except the limestone on this east to west line. Small pieces of sandstone are found in small quantity on the surface on the south and southeast portions of the rim, which are almost certainly from the Red Beds, 1000 ft. below. On the whole, there is vastly more fragmentary material to the southwest, south, and southeast than in the opposite directions, and it is more comminuted. The limestone cliffs inside the crater are more shattered to the southwest and south, and the limestone bed is raised higher. To the southeast is the great wedge at the fault in the cliff rim. The larger fragments, of 10 tons and upward, are also further from the crater on the south and southeast sides. The lowest point on the rim is on the north, a little west of a north and south line through the centre. All this shows that the force acted more violently in a southwest, south, and southeast direc-

tion. There is a little red sandstone butte one-half mile north of the hole. Over this a jet of the crushed material and rock was spurted, falling on the near slope and across the top, and on the plain beyond for a few hundred feet, but being absent for 50 ft. on the north or lee side of the hill.

From topographic surveys Gilbert found the contents of rim and hole about equal, and judged there was not room for a large buried meteor. Tighlman, judging from surveys, thinks the rim is short many million cubic yards of the quantity necessary to fill the hole, and that if there had been a steam-explosion, large quantities of the fine material would have been blown entirely away, and consequently there might be a deficit allowing room for a buried meteor.

The inside slopes of the walls of the 600-ft. crater are very steep, in places perpendicular, until near the bottom of the Aubrey limestone, where there is an extensive talus of red standstone, limestone, and gray and white sandstone, reaching 1000 ft. from the walls, leaving a flat central plain in the 3800-ft. hole 1800 ft. diam. The talus generally extends for 400 ft. on a 6° slope under this central-plain area. Near the centre five prospecting shafts from 30 to 200 ft. deep, and five drill-holes 305 to 1003 ft. deep, have been sunk in search of the buried meteor.

A lake has occupied the crater in recent times and deposited 100 ft. or more of lake-silt in the centre of the hole; below the lake beds is 300 ft. of almost impalpably powdered rock, consisting of 95 to 99% silica, with red sandstone, yellow limestone, and white sandstone boulders scattered indiscriminately through it. For the next 200 ft. the powdered rock gets continually coarser, and contains more of the unbroken sand-grains, until it is almost entirely gone. North 15° East, 510 ft. from centre of the hole the rock in place was struck at 147 ft., and proved for 53 ft. by a shaft, while at 250 ft. southeast of the centre it was 890 ft. deep, as proved 113 ft. by a bore-hole. In the shaft the rock dipped downward and outward, corresponding to the rock exposed in the crater walls, but was more shattered and disintegrated; in the drill-hole it was hard. The silica or rock-powder is very fine, much of it passing a 100-mesh screen, and it is supposed to have been formed from the white sandstone underlying the Aubrey limestone by the impact of the meteor. Thus it would be the result of crushing, and not of heated waters. Barringer, Tighlman, and Fairchild think it was thus made instantly; Merrill assumes that the pumiceous portion resulted from heating of the water contained in the sediments from heat generated by the impact, and that in fact the water was converted into steam, which furnished explosive power, and aided the impact in forming the hole. Under the microscope some of the broken sand-grains are half as large as the original grains of the sandstone, but the vast majority are much smaller, and many are invisible under an ordinary lens. The minute fragments are clear transparent quartz, looking like broken ice; they are of every conceivable shape, with sharp edges, and translucent; but much is impalpable powder. It is sometimes coarse enough to be gritty between the teeth, but no particle is larger than the grains from the original sandstone. After formation this silica poured out over the edge of the hole like flour out of a barrel, and practically composes the rim-slope, but is everywhere mixed with angular sandstone and limestone, with exposed blocks of all sizes on the surface. Where observed inside the crater, the sandstone under the limestone is altered in the same way. The effect of this incoherency in the sandstone would be expansive and should arch the beds into the quaquaversal dip observed.

The meteor is thought to have been at least metallic on the outside, and 2000 pieces of iron weighing from 1000 lb. down to a fraction of an ounce, have been found round about the crater, and as far as 2½ miles away, amounting in all to about 15 tons. They are known to collectors as the Canyon Diablo siderites. Four pieces weighing 3 to 4 lb. were found inside the crater. These siderites contain a trace of silicon, sulphur, phosphorus, and sometimes of platinum and iridium, 1½% carbon, 8 nickel, 90 iron. Also black diamonds, esteemed the most interesting of all such occurrences, are found. Besides the iron fragments, or siderites, many pieces of iron-shale have been found; seven weighing from 1 to 30 lb., coming from a shaft 48 ft. deep inside the crater. These shales are in general composed of hydrated iron oxide, with sometimes a kernel of siderite; they also contain some magnetic iron oxide, green hydroxide of nickel, iridium, and platinum. The iron-shale is thought to be an oxidized product from the siderites, or else portions of the meteorite rich in chloride and sulphide of iron. These and the magnetite are found attached to some of the iron specimens. The magnetite is thought to have constituted the tail of the meteor. The magnetite is described as fused and massive, and at the same time stratified and laminated. In general appearance it is different from any terrestrial magnetite. The magnetite in fine particles is generally distributed in the crater-filling, and occurs in several forms, such as scales like those produced in forging iron, or as small brown particles, and also as blackish-gray, rather fine-grained powder, strongly attracted by a magnet. This is crystalline in structure, though not in shape. It is sometimes round like shot, as if condensed when falling; it exists as a cement or partial coating of sand-grains, and also as a coating over metallic iron globules. Rock-fragments cemented by the iron oxides into dark lustrous masses occur, which suggest fusion, but Fairchild says it is from solution. The iron or 'siderites' are thought to have been torn loose from the meteor under the strain of expansion, when that body at the intensely low temperature of outer space, entered our atmosphere. The fragments then fell behind the meteor itself, and reached the earth after the catastrophe. Since working the property in April 1904, Barringer saw a meteor fall in central Arizona, from which five drops were detached. If these were large enough to escape entire combustion they would reach the earth as fragments separate from the meteor.

In the 15,000 ft. of shafting and boring done no

large meteoric mass has been found, but in one of the drill-holes impassable obstructions were found, and a magnet brought up material assaying 0.4% nickel. Gilbert made magnetic surveys to test the meteoric hypothesis without finding any disturbing influence. Tighlman suggests as an explanation that the meteor may now consist of polarized fragments forming a series of closed magnetic circuits with practically no external field. Experiments showed that individual pieces of the iron-shale, from an inch down to a mere grain, exerted an influence upon a magnet, but that an aggregation of grains did not. Mr. Tighlman is quoted as an authority on projectiles, and he says that a projectile will form a shallow crater five times its own diameter, and the crater will still be round when the impact is 20° from the vertical, so a 500-ft. body, traveling five miles per second, might make this crater of 4000 ft. diam. and 600 ft. deep.

The shafts and drill-holes have been sunk by the Standard Iron Co. of Philadelphia, in which Messrs. Barringer and Tighlman are the prime movers. They hoped to find meteoric material of economic value, especially rich in the rare metals. Thirteen drill-holes at depths of 400 to 680 ft., in a zone 20 to 100 ft. thick, found meteoric material in the crater-filling as follows: (1) silica cemented into greenish lumps, (2) a black vitreous material, (3) grains of native metal (schreibersite?). All three contained iron and nickel. Fourteen holes reached solid rock at depths of 600 to 720 ft., while two others, close to the centre, went 1030 ft. deep for a solid core. Cedars 700 years old are growing on the rim, so the age of the crater is put at a few thousand years. This records a startling physical event. It would be interesting if the hole should really prove to be the result of solfatarism, and if the somewhat elusive meteoric elements within it were to be traced to the same source. It would ally itself to the irons of Ovifak.

Mining has the greatest future of any Siberian industry. Gold in placers is the chief mineral product at present. The chief centres of gold mining are the Altai, the Marinsk district of Tomsk, the southern parts of the province of Yeniseisk, the Ynisisk district in the north of the same province, the Nerchinsk and the Vitim districts of Transbaikalia, the Olekma and Vitim districts of Yakutsk, and the Bureya and Zeva districts of the Amur province. Some gold is also extracted by the Chinese in the south Ussuri region. No statistics as to the amount of gold produced in Siberia can be obtained, as the figures are contained in the total output of the Russian Empire.

Mushet steel was not, strictly speaking, high-speed, but it was at any rate the forerunner of high-speed steel, and the development of the latter grew out of the former. The composition of the original self-hardening steel, R. Mushet Special is:

	%
Carbon	2.0
Tungsten	5.0
Chromium	0.5
Manganese	2.5
Silicon	1.3

REFRIGERATION WITH ETHYL CHLORIDE.

Ethyl chloride is the monochloride of ethyl (C_2H_5Cl). It is the product of ethyl alcohol treated with hydrochloric acid gas. It is a colorless liquid with a specific gravity of 0.925 at 23° F. (specific heat, liquid, = 0.4276; gas = 0.272). Its boiling point under atmospheric pressure is 54.5° F. Its critical temperature is 365° F. (under a pressure of 53 atmospheres), and its latent heat is 174 B.T.U. at 23° F. It is a neutral chemical and shows only the slightest trace of acid upon litmus paper. It is neither deleterious nor obnoxious, and should it be necessary at any time to repack the valve stem or the stuffing box of the compressor no inconvenience is experienced from escaping gas. It possesses nothing in common with either air or water, consequently, should by accident either of these elements be introduced into the system, no chemical change would occur. As the critical temperature is high, there is no generation of permanent gases to impair the efficiency of the refrigerating system, and it does not deteriorate in value as a refrigerating medium. It is apparently just as good and efficient after a year's use as when first made. Its boiling point being high, it has a correspondingly low point of liquefaction under pressure, namely, 15 lb. per sq. in., gauge pressure, with condenser water at 65° F. Its pressure being low, the loss of chemical in action from leakage is reduced to a minimum. Its low pressure, together with its being a neutral, insures long life to the machine. It is not, however, applicable for sharp freezing or for temperatures of zero or below, but it is a favorable chemical in the manufacture of ice and in the production of the ordinary storage temperatures. Ethyl chloride approaches nearer to the ideal chemical for refrigeration than any other now in use. It seems destined to a prominent place in that field, not only on account of its stability and the ease with which it can be handled in a machine, but also from the fact that in the near future it will be manufactured from denatured alcohol, free from government tax, which will make its cost practically the same as several of the other chemicals used in mechanical refrigeration. —C. C. Palmer, *Trans.* Am. Soc. Ref. Eng.

The average annual production of pig-iron in the Ural and Siberia (separate statistics for Siberia not given) from 1902 to 1906, inclusive, was 657,440 tons. The Siberian output of coal, chiefly from the province of Akmolinsk, rose from 660,770 tons in 1902 to 1,325,400 tons in 1905. Copper is mined in small quantities. More and more foreign capital is becoming interested in the mineral wealth of Siberia, and American miners are prospecting in those parts of the Primorskaya opposite and near Alaska. The engineers of the Trans-Siberian committee have undertaken to thoroughly investigate the mineral resources of Siberia, and have discovered oil wells at Soudjenka and Tcheremkovo, which furnish some oil for the Trans-Siberian railway.

To find tons of rail in one mile of track, multiply weight per yard by 11 and divide by 7.

COMPANY REPORTS.

SKIDOO.

The Skidoo Mines Co., of Los Angeles and Skidoo, publishes a report for 1908. Skidoo is a camp in Inyo county, California. The president is E. A. Montgomery, who signs his name E. A. (Bob) Montgomery. Charles M. Schwab is a director. H. W. Squires is superintendent at the mine. The plant includes a 10-stamp mill, with a cyanide annex. Five more stamps are being added. The financial statement is unique:

Table No. 1, showing receipts and expenditures for period from March 30, 1907, to December 31, 1908:

RECEIPTS.

E. A. Montgomery	$400,000.00
Bullion receipts	110,505.81
Enterprises	1,455.98
Current accounts payable	26,880.22
Surplus account	1,117.29
Total	$539,959.30

EXPENDITURES.

Outlay	$469,117.93
Operation	61,117.28
Bills receivable	8,707.60
Cash	1,016.49
Total	$539,959.30

Table No. 2, showing receipts and expenditures for operation for period from June 30, 1908, to December 30, 1908:

RECEIPTS.

Bullion	$101,379.54
Enterprises	771.27
Surplus account	1,117.29
Total	$103,268.10

EXPENDITURES.

Operation	$ 53,533.45
Profits earned	49,734.65
Total	$103,268.10

This balance sheet is absurd. Montgomery is Schwab's representative. The Skidoo Mines Co. was organized with a capital of $400,000, which was estimated to be sufficient to put the mine an a dividend basis, but more money was required. A dividend is promised for May 1, 1909. The ore in reserve is given at 49,320 tons, worth $812,000, not including low-grade stuff.

BOSTON CONSOLIDATED.

A report affording so candid an exposition of the affairs of a copper company, would have been impossible a few years ago. The report of the Boston Consolidated Copper & Gold Mining Co. covers operations for the year ending September 30, 1908; it is unsatisfactory without being discreditable. The lack of a sufficient ore supply prevented the operating of more than four sections of the mill between January and September, when an additional four were put to work. It had been intended to extract the ore from the Porphyry mine by steam-shovels. When the capping was removed, however, it was found that the proportion of valueless iron pyrite in the ore was so large as to prevent a concentration of more than 10 to 1 instead of 18 or 20 to 1, as originally intended. This necessitated temporary abandonment of steam-shovel work for mining by the caving system. The ground was blocked out in squares of 60 ft. to a side, thereby extracting 128,390 tons, for a footage of 22,100 ft., and at the same time increasing the ore available to the extent of about 780,000 tons. The probable extent of orebodies in the Porphyry mine is estimated by Sidney J. Jennings, the consulting engineer to the company, as being 27,889,000 tons with an average content of 1.6% copper, and worth an additional 7c. per ton for the recoverable value of gold and silver. A further block of 9,550,000 tons is also indicated which will barely pay expenses with copper at 13c. per pound, but will yield a profit with copper at any higher price. Its average copper content is 1.45%. Financial reasons prevented an adequate amount of prospecting in the Sulphide mine, in the southern portion of the property. The variable quality of the ore makes it impossible to estimate with any degree of exactness the amount in reserve, but Mr. Jennings conservatively places it at 72,000 tons of payable ore. The mill crushed 149,650 wet tons of an average value of 1.49% Cu, producing 9935 tons of concentrate. The average of the last three months showed a duty of 8.73 tons per day for each Nissen stamp, which indicates a capacity for the whole mill of 2642 tons per 24 hours. With a heading averaging 1.49% and a tailing of 0.425% the mill-recovery appears as 71.5%; the mean cost for the 8 months was 60c. per ton crushed, but fell to 47.2c. for that month, namely, September. Itemized expenses cannot fairly be given per ton of ore crushed, owing to the diversity of operations; steam-shovel stripping of 411,175 tons cost 17.7c. per ton; mining 26,647 tons by the same method, 56.3c.; underground mining of 128,400 tons in the Porphyry mine, $1.16; 77,540 tons from the Sulphide mine, $2.87; milling, 60c. per ton; smelting ore, $4.15; and general expense 45c. per ton. The total amount realized is $932,000, leaving the company with a net loss for the year of $164,000. It is proposed to issue a further £100,000 of capital to clear off this and other liabilities due for construction work, and thus place the company on a sound financial basis, with the advantage that profits from this time forward may be available for dividends.

RIO PLATA MINING CO.

The annual report of this company covers the period of eleven months ending November 30, 1908; it is issued from the New York office, whence the mines in Chihuahua, Mexico, are managed. The sales of bullion and concentrate brought $315,624 for a cost of $100,886, leaving a profit at the mine of $248,609. After paying for all debts on plant and property a balance of $85,280 remains, together with 34,235 shares of treasury stock. The 25-stamp mill crushed 14,093 tons of ore with an average silver content of 82.4 oz. per ton; 56% of the silver was saved, the remainder going to the tailing pond, where it is stored for future cyanide treatment. An electrically equipped cyanide plant is in course of erection, and was to be ready for work in March. Tests by the general manager, D. W. Shanks, show that 85% of the silver in this tailing should be saved. During the period covered, 1018 ft. of development work have been done in the mine, mostly in ore; but no indications are shown in the report of the tonnage blocked out, the ore reserves, nor of the future prospects of the mine in any way. Consequently the report cannot be considered as anything but unsatisfactory.

NUNDYDROOG.

This is one of the gold mines in the Kolar district of India. The annual report for 1908, issued recently to the shareholders, shows continued prosperity. During the year 87,000 tons of ore was crushed and amalgamated for a yield of 74,851 oz., an average of 17 dwt. 5 gr. per ton. In the cyanide annex 70,804 tons of tailing was treated, giving 6038 oz. gold, equal to 1 dwt. 17 gr. per ton. The total of 80,889 oz. exhibits an increase of 5925 oz. as compared to 1907. The gold was worth £303,807 and the profit on revenue account was £140,592. Dividends were diminished by a fire in the mine, a sum of £12,000 being held for contingencies. In order to smother this fire the pumps were stopped, the workings dammed, and the shafts covered tightly. The mine is now being unwatered and the total damage is assessed at £7000. The ore reserves are estimated at 120,895 tons as compared to 111,640 the year before. The deepest workings are at 2600 ft. Thomas Richards is the superintendent: John Taylor & Sons are the managers.

RECTIFICATION OF NATURAL SULPHUR WATERS.

Written for the MINING AND SCIENTIFIC PRESS
By F. H. MASON.

In many parts of California are hot sulphur springs, so called because they contain varying proportions of sulphuretted hydrogen, the obnoxious smell of which makes the sulphur-content of the water evident. If it were possible to use these waters for irrigation, their value in arid districts would be enormous, for the flow is often considerable, and there appears to be a fair degree of certainty as to the depth at which they may be found in the districts in which they occur. Unfortunately, up to now, attempts to use these springs for irrigating purposes do not seem to have met with great success. At the Hotel el Paso de Robles the grounds are watered with sulphur-water straight from the earth; the water is delivered from a sprinkler and at a good force, said to be 45 lb. per square inch; under this pressure the spray is thrown so far that by the time it reaches the ground it has acquired a temperature approaching that of the surrounding air, and has lost a large proportion of its sulphuretted hydrogen. The result, though vastly superior to the surrounding country that gets no water, would, were it in the neighborhood of a smelter, convince the average jury of twelve farmers that it was a case for heavy damages. The grass is an unhealthy green, with the brown blades far outnumbering the green ones, the prettily grown cypress trees have an unnatural brown tinge, and the vegetation in general has an unhappy appearance.

Speaking from the standpoint of one who has had a fair amount of experience in the adaptation of waters to industrial purposes, I am of the opinion that these sulphur-waters might, in many cases, be made suitable for irrigation by aeration; and further, that by a simple and inexpensive treatment they might be made into better water for household purposes than many that are supplied to small towns in California and elsewhere. Take, for instance, the town of Paso Robles. The main sulphur spring, according to the published analysis, has 101.47 gr. of solids per U. S. gallon, which is, of course, high for a potable water, but, in the absence of analysis, I am inclined to think that the town-water, which is highly calcareous, contains at least an equal amount. In the sulphur-water the solids are principally bicarbonate and chloride of soda; the solids in the town-water, on the other hand, are mainly bicarbonate and sulphate of lime, which are far more objectionable ingredients. Of course, the town-water would be much easier to rectify, and if rectified would be a better water than could be made from the sulphur-water. It could be treated by Clark's process, that is, the addition of sufficient lime-water to convert the soluble bicarbonate into insoluble carbonate of lime, and then removing the latter by decantation or filtration. But the town-water has to be pumped, while the sulphur-water is artesian and will rise to an elevation of 100 ft., which is all that is needed to supply the buildings in the town.

All that would be required, in the way of plant, to treat the sulphur-water would be two large tanks or reservoirs, a small blower, and motive power. The tanks or reservoirs would have to be at a sufficient elevation to deliver water over the area it was desired to irrigate. In the bottom of each tank should be placed a coil of pipe, punctured with numerous pinholes, and connected with the blower. As soon as a tank had been filled about three quarters full a current of air should be passed through. This would drive out most of the sulphuretted hydrogen, and, if continued long enough, would oxidize the little it does not remove, rendering it innocuous to plant life. Should it be required to further treat the water, filtration through Weldon* mud or wad would undoubtedly convert many sulphur-waters into good drinking and irrigating waters. Filtration through hydrated oxide of manganese, the principal constituent of both Weldon mud and wad, will remove the last traces of sulphur, existing as sulphide, which is the cause of the unpalatableness of sulphur-waters; the sulphur going over to the manganese to form an insoluble sulphide of that metal. The great advantage of these substances as desulphurizing agents is that when they become fouled, that is, when the manganese hydrate has been converted into sulphide, they may be revivified by passing air through them, or by exposing them to the air. The sulphur thrown out of combination by the oxidation of the sulphide of manganese will be in the free state practically insoluble and inert. The wad or Weldon mud may be kept in use until it contains from 50 to 60% of sulphur, when it may be either sold to the sulphuric acid manufacturer, or the sulphur may be extracted by suitable solvents and converted into roll-sulphur for the market on the spot.

*Weldon mud is the precipitate formed by adding milk of lime to manganese chloride or sulphate, obtained as a by-product in the manufacture of bleaching powder.

The metals produced in Mexico for exportation are silver, gold, copper, lead, zinc, and antimony. For domestic consumption, and in limited amounts, the country also yields iron, quicksilver, and tin. The statistics for the year 1906-07, which are a close approximation to the truth are:

Gold	892,825 oz.
Silver	57,925,916 oz.
Copper	113,879,646 lb.
Lead	154,323,400 lb.

Zinc ores assaying from 20 to 60% were produced to the amount of 100,000 metric tons. These exports represent an approximate value of $73,000,000 gold. Only in the yield of silver does Mexico occupy first position among the world's producers. In order to impart an idea which may be easily retained in the memory it may be said that, if the production were uniformly distributed over the entire area of the country, each square kilometre would afford annually about one kilogram of refined silver.

The cubic contents of a cone may be found by multiplying the square of diameter of the base by 0.7854 and the product by the height, and then divide this result by 3.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

QUIETING TITLE TO MINING CLAIM—EVIDENCE.

In an action to quiet title to a placer mining claim the evidence showed that the plaintiff had located the claim, marked its boundaries by stakes and monuments, put up and recorded a proper location notice, and then entered upon peaceable possession, thereafter sinking two shafts to bedrock, and that gold was first discovered at a depth of 72 ft.; that there were no other excavations on the claim except a hole a foot or so in depth. This was said to be sufficient prima facie proof to show that at the time such location was made the ground was unappropriated public land of the United States, its mineral character being admitted, although the proof also showed that there were other stakes and location notices within the limits of the plaintiff's claim, which were not shown to belong to the defendant; but this alone could not affect the plaintiff's title, as a discovery was essential to a valid prior location.

Cook *v.* Klonos, 164 Fed., 529, Oct. '08.

GAS AND OIL LEASE—GRANTS AND RESERVATIONS.

The owners of land executed a 20-year oil and gas lease, and thereafter agreed to make a new lease for 10 years from the expiration of the original lease, and on the same terms. Subsequently such land owners executed a deed for the land, reserving to themselves all the oil and gas from the date of the deed to the expiration of the extension of the original lease, and also the right to execute a new lease for 10 years after the expiration of the original, and on the same terms. This reservation made by the land owners was held to be for the purpose of retaining the rights which they had in the lease until the expiration of the original lease, and then to extend the same for 10 years.

Collins *v.* South Penn Oil Co. (Pa.), 71 Atl., 319, Nov. '08.

CONTRACT TO LEASE OIL LANDS—CONSTRUCTION.

One of the lessees in a lease of oil lands assigned his interest therein, and thereafter bought a fourth interest in certain lands not covered by the original lease; the owner of the leased land then made a written contract with the owner of such one-fourth interest in other lands, in which it was stated that he was part owner in such land, and that when he became owner of the other three-fourths he would extend the original lease to such owner of the one-fourth interest; in consideration thereof the latter promised to surrender a certain interest in the oil produced, as provided by the original lease. In an action on the contract it was held to refer only to the fourth interest in the land purchased and not to the land covered in the original lease.

Collins *v.* South Penn Oil Co. (Pa.), 71 Atl., 319, Nov. '08.

LEASE OF MINE—TRANSFER.

The lessees of a mine agreed with a certain person to transfer the lease to a corporation to be organized by him, in consideration that he would contribute as capital a certain sum within a certain time, and an additional amount at a later date, such agreement being for the express purpose of raising money to continue the business. In an action to rescind the lease the court decided that the promise of such third person to contribute the amount of money promised was a condition subsequent, the failure to perform which was sufficient to justify a rescission of the transfer of the lease, and that the remedy of the lessor for damages was inadequate.

Schneider *v.* Miller, 113 N. Y. Supp., 399, Dec. '08.

ENTRY OF MINE FOR DISQUALIFIED PERSON.

The United States Statutes prohibit a qualified person from entering coal lands apparently for himself, but in reality as the agent for a person who is disqualified by reason of having already entered the full quantity permitted by law.

United States *v.* Keitel, 29 Sup. Ct., 123, Oct. '08.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

THE GAS ENGINE. By Forrest R. Jones. 8vo., pp. 446, Ill., Index. New York. John Wiley & Sons. 1909. Price $4.

The work in hand is of a sort that gives comfort and satisfaction to an engineer of training. It is not a book for the layman. It presupposes a knowledge of physics and a certain acquaintance with power-problems. The types of motors, large and small, are described, with illustrations. Carburation of air, ignition and control of power and speed, are each given a chapter, the latter being most elaborate. Other points to which chapters are given are lubrication, disposal of exhaust gases, starting and adjusting the motor, setting or timing valves and igniter, and a chapter on troubles which will awaken painful memories in the minds of many sufferers. Instead of leaving the reader with the troubles, Mr. Jones ventures to suggest remedies, thereby recalling the assurance of the usual expert when not confronting the particular crisis. But the suggestions are practical and helpful. In addition, the work discusses in detail the more highly technical side of gas engines, explaining the interpretation of indicator cards, physical properties of gases, combination and heat values, theoretical heat-cycles, and so forth. It is a most useful and instructive book.

CLAYS: THEIR OCCURRENCE, PROPERTIES, AND USES. By Heinrich Ries. 2d Ed., 8vo., pp. 554, Ill., Index. New York. John Wiley & Sons. 1909. Price $5.

This admirable treatice has become a standard which no technical man can omit from his library. Whether one be specifically interested in clay or not, the book is so full of geologic fact, brought out in the elucidation of the occurrence and formation of clays, that it becomes pertinent for a wide range of professional readers. The new edition has been enlarged by additions to the chapters on occurrence, properties, and geographic distribution.

Santa Cruz folio of the U. S. Geologic Atlas. No. 163 of the series. Descriptive text, 3 maps and 2 illustration sheets. Obtainable for 25c. from the U. S. G. S., Washington, D. C.

Catalogues Received.

The WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, has recently issued circulars No. 1160 and 1164, the former on tungsten lamps and the latter on mill motors.

THE FOOS GAS ENGINE CO., Springfield, Ohio, has just published an attractive catalogue on horizontal engines. The pamphlet is replete with illustrations and is interesting reading.

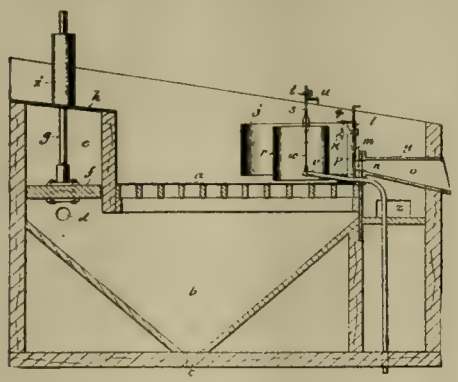
The NELSON VALVE CO., Philadelphia, has just issued its 1909 catalogue, a cloth-bound volume of 220 pages, which is a valuable addition to any library of trade publications. The company will send it free to anyone interested.

THE LUDLOW-SAYLOR WIRE CO., St. Louis, Mo., has just issued its 1909 catalogue, describing its line of steel, brass, copper, and bronze wire cloth. It contains complete information about and prices of the different styles of wire cloth made by this company. Several pages of conversion of metric to English units and for the comparison of different wire gauges, make the catalogue valuable as a handbook for engineers.

THE PELTON WATER WHEEL CO., San Francisco, has just issued the 1909 edition of its catalogue, which is a handsome volume of 116 pages, illustrated in color. Because of the interest attaching to this branch of engineering, which has recently become an exact science, and which is so admirably described in this publication, the book should be in the hands of everyone interested in hydraulics or water-power supply, because of the information it contains on the measurement of water, loss of head due to friction, horsepower of falling water, and the like.

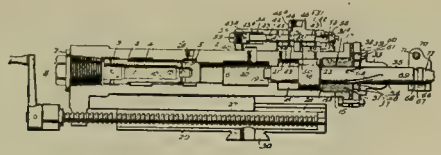
MINING AND METALLURGICAL PATENTS.

APPARATUS FOR TREATING ORE.—No. 914,002. Frederick E. Woodbury, Milwaukee, Wisconsin, and Benjamin Harris and Centennial H. Benedict, Lake Linden, Michigan.



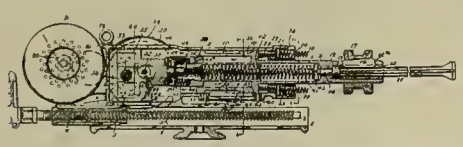
In apparatus for treating ores the combination with a crusher and a concentrator, of an intermediate classifying jig comprising a screen and means for producing pulsations of water through the screen and provided with a plurality of discharges above the screen, including a slimes discharge and a discharge for material requiring further treatment, and with means for restricting the volume of water passing out with the slimes, a conduit leading from the discharge for material requiring further treatment to the concentrator, and a conduit from the crusher to the classifying jig, substantially as described.

ROCK-DRILL.—No. 913,928. John A. Traylor, Denver, Colorado.



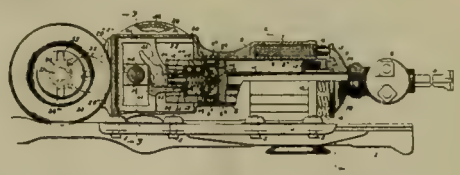
In a rock-drill, a casing, a cylinder, a hammer piston cylinder, and a hammer piston reciprocally mounted in said cylinder, a chuck chamber in said casing, a chuck reciprocally mounted in said chuck chamber, a drill bit secured to said chuck in position to be struck by said hammer piston and arranged in operative drilling relation to rock, a valve chest and a valve operatively connected to said cylinder and chuck chamber, means whereby a supply of actuating fluid is conveyed to said hammer piston and said chuck to move said drill bit and hold it by the pressure of said actuating fluid against the rock being drilled until struck by said hammer piston.

ROCK-DRILL.—No. 914,215. Thomas E. Adams, Cleveland, Ohio.



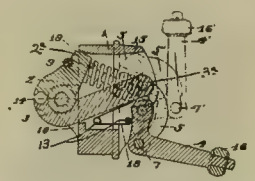
In a drill, the combination with a drill barrel having an annular series of pockets in its forward portion, and a reciprocating drill rod located centrally in said barrel and projecting forwardly beyond the same, of a series of springs located in the annular series of pockets and projecting forwardly beyond the same for propelling the drill rod forwardly, and a plate or head on the drill rod beyond the barrel, to receive the force of said springs to propel the drill rod, means for withdrawing the drill rod to store the energy of the springs, and means for releasing the withdrawing means at the rear end of the throw of the latter, from the drill rod.

ROCK-DRILL.—No. 913,932. Thomas E. Adams, Cleveland, Ohio.



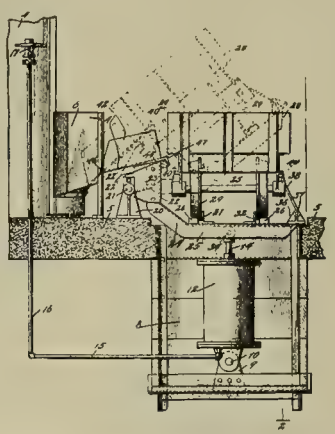
In a drill, the combination with a drill rod and a propelling spring therefor, of means movable in the same direction as the forward throw of the drill rod to compress said spring, devices for connecting said means with the drill rod after the spring has been compressed for moving the drill rod and compressed spring rearward during the return movement of said means, and trip devices for releasing the drill rod to the action of the propelling spring.

GRIP MECHANISM FOR CABLE-TRAMWAYS. No. 913,775. Rugeley D. Seymour, Denver, Colorado.



In mechanism of the class described, the combination of a suitable frame, two gripping jaws mounted opposite each other and adapted to engage each other, mechanism engaging one of said jaws capable of being swung to two different positions for the purpose of moving said jaw between open and closed position of the jaws, and yielding spring mechanism connected to the other jaw whereby said jaw may automatically adjust itself to varying sizes of rope.

CUPOLA CAR-DUMPING MECHANISM.—No. 911,725. James Hyslop, Harvey, Illinois.



In a device of the class described in combination with a tiltable platform and a track for a car thereon a rigid hook pivotally mounted at one side of the track adapted to detachably engage a portion of the car for the purpose of securing it upon the track and guard flanges inside of and adjacent to each rail adapted to engage the flanges of the wheels of the car for the purpose of holding it upon the track.

PROCESS OF DETINNING.—No. 915,029. Franz von Kugelgen and George O. Seward, Holcombs Rock, Virginia.

The recovery of tin from tin scrap by treating the latter in a closed vessel with dry chlorin to form stannic chloride, controlling the temperature to keep it high enough to effect complete detinning but low enough to prevent attacking the iron and to condense within the vessel such of the stannic chloride as is vaporized, and draining the liquid stannic chloride from the residue of iron scrap within the vessel.

Methods of Testing Electric Detonators.

Written for the MINING AND SCIENTIFIC PRESS
By WILLIAM W. NICOLL.

Those who use electric detonators in firing blasts will be interested in a new electrical testing instrument known as the 'Blasters' Friend', recently devised by the New York Blasting Supply Co. of New York. Owing to the necessarily delicate construction of the platinum wire bridge in the shell of a detonator, it frequently happens that it becomes broken or disconnected; thus destroying the circuit and rendering the detonator worthless. In many cases, misfires and premature explosions are caused by defective detonators. Heretofore, to detect the deficiencies of a detonator before using has been an impossibility, owing to the absence of a testing instrument adapted to the purpose.

The component parts of the new device consist of an extremely sensitive chloride of silver battery, to which are connected two separate solenoids, which are carefully tuned with the ignition wire in the detonator. The outside of



the instrument contains two metal posts, which when connected produce a magnetic flux actuating a small piece of metal attached to a staff, to which is affixed the designating vane, or as it is termed, the 'O. K.' disc. The outside poles, when connected, cause the current to flow through the wires and platinum bridge of the detonator, energizing the solenoid which actuates the staff carrying the designating vane and causing the 'O. K.' disc to come to a common centre. The face of the disc, upon which is stamped 'O. K.' shows through a glass dial in the side of the instrument, thus designating that the circuit is complete. When the wires are withdrawn from the instrument, the vane or disc disappears from view. The operation of testing a detonator is extremely simple; place the end of each wire on the poles of the tester, and if the 'O. K.' disc appears it is perfect; if the disc fails to appear, the detonator is defective. To test the entire blasting circuit: after all holes are loaded, connected, and the leading wires attached, before connecting the blasting machine or electric current, place the end of each leading wire on the poles of the tester, and if the 'O. K.' disc appears the entire circuit is complete; if the disc fails to appear there is either a ground, broken wire, or poor connection requiring adjustment before the blast can be fired.

From the above description of the 'Blasters' Friend' and the explanation of its use, its importance as a part of the equipment for blasting is apparent. The instrument is mounted in a case, which is substantial, and covered with black leather; the dial-glass is surrounded and retained by a lacquered brass retaining-ring, about the size of a watch crystal, locked from the inside. The instrument can be carried in the hip or side-pocket without inconvenience, ready for instant use.

Screening in Utah Copper Co.'s Mill.

As originally designed and equipped the mill of the Utah Copper Co. contained trommels as the main screening equipment, the undersize passing over stationary inclined screens. Each of the twelve units comprised four 48 by 144 in. trommels, and two inclined flat screens, the trommels being clothed with rolled-slot wire-cloth, equivalent to about No. 6 mesh, and the stationary screens with similar material passing a product equal to about No. 20 mesh. Shortly after the first units were placed in commission the usual difficulties in the operation of trommels became apparent, and more efficient and economical equipment was sought. A number of devices were tried on a working scale. The results were so favorable to the impact-screen that it was determined to equip the twelfth unit, at that time nearing completion, with these screens, and to demonstrate conclusively in it the adaptability of the machine for the work. The twelfth unit was operated with improved results, due to closer sizing, and with a capacity of 600 as against 500 tons per day, owing to the tables being able to handle a greater tonnage of the more closely sized feed. The screens in this unit were running wet. The work of replacing all the screens throughout the other units of the mill was then determined upon, and has proceeded as rapidly as possible without undue interference with operations. Sufficient time having now elapsed to permit of comparison between the two, the net result of the change can be summarized as follows: The capacity of each unit has been increased from 500 to 600 tons per day, the tables handling the increased feed by reason of the closer sizing. There has been effected a saving of about one-fourth of the water formerly used by the trommels because of running the four coarse impact-screens, the crushing rolls, and the elevator on the ore dry as it comes from the mine without the addition of water. This also increases the life of the elevator from 4 to 18 months. The cost of screen-cloth is in the ratio of $128 for the trommels, to $14 for the impact-screens. The impact-screens were made by the Colorado Iron Works of Denver, Colorado.

Commercial Paragraphs.

THE DENVER FIRE CLAY CO., Denver, has recently published a bulletin describing a new crucible which, it is claimed, is a distinct improvement on other designs. The bulletin will be sent to anyone interested.

The MOORE & SCOTT IRON WORKS, San Francisco, has purchased the shipyard at Oakland, Cal., belonging to Boole & Sons. The consideration is said to be nearly half a million dollars. The new owners will enlarge the capacity of the plant and will build a dry-dock of 5000 tons capacity.

WM. AINSWORTH & SONS, Denver, announce that they have recently received orders for analytical balances with Ainsworth multiple rider carrier from the U. S. Food Inspection Laboratory, Denver; the U. S. Mint, San Francisco; and the Watertown Arsenal, Watertown, Massachusetts.

The GENERAL ENGINEERING CO., Salt Lake City, Utah, has added a contracting department, and has entered the field as contractor for the erection of milling plants and the installation of the necessary machinery. This company's ore-testing establishment continues an important adjunct to the business.

The Wall Street Journal of March 17, 1909, contains an article reviewing the affairs of the WESTERN ELECTRIC CO. for the first quarter of the fiscal year 1909, in which it is shown that the business of this concern for the period stated amounted to 30% more than for the same period in 1908, while the increase in the number of customers was 40%. The company is operating at about 70% of its capacity.

THE BEHREND DRY CONCENTRATOR CO., of 10 Wall St., New York, recently installed a test plant, under their system, for Senator A. B. Lewis, in Salt Lake City, Utah. The plant was completed in February of this year, and began operation on lead-zinc ore of a complex nature, containing sulphides of lead, zinc, iron; carbonate of lead and silicate of zinc; in a quartz-baryta gangue. This ore occurs at Pioche, Nevada. The tests were successful and proved beyond doubt the applicability of this system of dry concentration to these ores, and its commercial utility for making products of high value at a low cost. Mr. Lewis has decided to install a Behrend dry concentrating plant of large capacity on one of his properties at Pioche, Nevada.

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EDITORIAL.

IT IS PROPOSED in Texas to enact a mining code following the Mexican rather than our national plan. Texas, by reason of having retained control of its public lands when admitted to the Union, is in a position to adopt the code which best applies to local conditions.

IT IS pleasing to announce that Mr. R. M. Raymond, after distinguished services in the upbuilding of the great operations of the El Oro Mining & Railway Company, has become managing director of the enterprise, and will henceforth reside in Mexico City. The duties of personal supervision of the property will devolve upon Mr. Alfred F. Main, who has been promoted to the position of general manager, which is a proper reward for long and able service.

THE STRIKE at the Broken Hill Proprietary mine is being conducted with much vigor and many picturesque accompaniments. Tom Mann, one of the leaders, being forbidden to make speeches in the district, has retreated to Melbourne, from which point of vantage he dispatches gramophones with canned eloquence to his followers. What arrangements are made to provide proper gestures, we are not informed, but if need be the cameraphone will doubtless be pressed into service.

NEVADA is not yet depleted of its rich ore. During the week we were informed concerning 160 pounds of ore from near Winnemucca that realized $10,000 at the Selby smelter; of the total value $7500 was in the form of 'metallics' or native metal collected on the laboratory sieve. But pounds of ore are not as impressive as tons of it; we hear that the Goldfield Consolidated shipped 6 carloads, or nearly 200 tons, that averaged 30 ounces of gold or $600 per ton; nine more carloads are on the way.

COLOMBIA keeps to the fore. Mr. F. Lynwood Garrison contributes another illuminating article to this week's issue, following the line of practical suggestions for travel and comfort in that country to which we had previously devoted space. Attention was called recently to the re-division of Colombia into smaller Departments or gubernatorial units, for the purpose of more efficient administration. The map accompanying Mr. Garrison's article shows the latest subdivisions of the Republic, and also exhibits the railroads now open.

IT HAS been determined that dredging costs bear an inverse ratio to the bucket-capacities. From the figures given in another column it is seen that a deduction was made of the equivalent cost of a five cubic foot dredge working in normal gravel. Applying the figures to eight and thirteen foot buckets re-

spectively it will appear from the costs given that the expenses in those cases should be 3.5 and 2.15 cents. These are actually the costs of dredging with buckets of those sizes by one of the leading companies of California.

A COMMITTEE of the Gold and Platinum Miners' Association of Russia has been investigating the possibility of substitutes for platinum, a question of great moment to them, and it reports that there is little likelihood of a substitute being found to take the place of platinum in most of its commercial uses. The only exception is the increasing use in chemistry of vessels made of fused quartz crystal. On the other hand, attention is called to several new uses for which platinum is fitted by its high melting-point and its resistance to chemicals.

OUR NEW YORK contemporary, having once placed the Mount Morgan, reputed to be the greatest gold mine in the world, in New Zealand, and having later credited it to New South Wales, has at last placed it in 'Central Queensland.' The *Queensland Government Journal* complains of this disinclination to credit the mine to its home State, and cites the declaration of a reputed visitor, speaking before one of the Institutes, to the effect that it was necessary to "leave Queensland on the late afternoon express" in order to reach the mine. The objection is natural, and in the interest of peace we hope the mine will be left hereafter where planted by nature.

WHETHER COPPER production or copper consumption will be in excess at any particular time is a matter of unfailing interest. The mines now open and being opened are undoubtedly capable of greatly increased production. It is much harder to make estimates of future consumption. As bearing on the problem, it is of interest to note that the American Telephone & Telegraph Company used over a million miles more copper wire in 1908 than in 1907. This is the report of only one consumer, but any one familiar with the extensions of telephones and electric traction systems now under way cannot doubt that the future will show not only a growth in copper consumption with increase in population, but a larger per capita consumption as well.

THE EAST AND WEST lines of the C., M. & St. P. railroad were connected last week near Missoula, Montana, and without fuss or ceremony a new trans-continental line came into being. The contrast between the quiet completion of this railway and the military and civil display which accompanied the driving of the golden spike on Promontory Point, marks the distance we have traveled since the Union and Central Pacific roads were completed. That was a great national achievement, binding together the East and the West, forestalling a possible new sectionalism. With the greater development of our resources and our growth in solidarity, the completion of our sixth transcontinental line becomes but a bit of the day's work. On the checker-board of business it is possible, however, that this building into the Northwest of a great railway, tributary neither to Hill nor to Harriman, may prove as potent as did, in our political history, the building of the overland route.

OIL discoveries continue to be heralded from central Nevada. They are easily made: When a drill-hole is lost, and pending the order for another equipment, a couple of barrels of oil are emptied into the hole and shortly afterward eager speculators arrive on the ground. As the water has risen, the oil also is near the surface, so that a bottle lowered at the end of a string brings up an encouraging sample. But Nevada is not the only region of wonderful discoveries, we are informed that in the desert (why is the desert such an incubator of yarns?) of southern California, within a mile of a railroad, there has been found a deposit covering 20 acres, of vaseline. Assuredly the modesty of the acreage affords convincing proof of the truth of the story, for any fabricator would not be content with a beggarly 20 acres; why not 200? This deposit is so soft that the observer sank to his knees in it, but he emerged, otherwise this had never been written. More proof!

APPLICATION for an extension of the receivership of Milliken Brothers, made before Judge George C. Holt of the United States District Court for the Southern District of New York, brings out the fact that the recent cut in steel prices has actually not stimulated industrial activity; on the contrary, conditions are worse than at any time since June 1907, at which time this concern went into a receivership. Naturally a mere reduction in the price of a great commodity which is practically controlled by a single corporation cannot restore confidence and promote new enterprise. As we pointed out some weeks ago, guarantees of prices for a definite period are essential, otherwise no contractor can venture to assume obligations, and development of new business is checked. The present policy of the Steel Trust is harmful to the entire nation. Incidentally it is driving the independents to the wall. The American Bridge Company is taking contracts at prices said to involve actual losses. All this tends inevitably toward absorption of the small producer. It is being accomplished at high cost, most of which falls upon the people at large.

PROGRESS is being made in the organization of the Instituto Mexicano de Minas y Metalurgia. At a meeting held in Mexico City on March 25 committees on membership, organization, finance, and meetings and proceedings reported. A general committee is now at work correlating these reports. The membership of this committee, including R. E. Chism, H. S. Denny, G. H. Garrey, E. P. Merrill, J. J. Reynoso, and Kirby Thomas, assures a successful outcome. It is too soon to say what form of organization will be adopted, but it seems that the plan of the American Institute of Mining Engineers will be closely followed. Provision for meetings of local sections is, however, to be made. That there has been a real need for this in the United States is shown by the success of the local sections of the Mining and

Metallurgical Society. It would seem at least doubtful whether in Mexico there is as yet the same opportunity to develop vigorous local bodies without throwing membership open to all comers. In this connection it may be noted that the proposed by-laws really leave the choice of membership largely in the hands of the council. This is perhaps a necessary temporary expedient, but is nevertheless dangerous. Centralized control makes for prompt success but is apt to discourage healthy individual activity. We hope the new society may escape all pitfalls and become a strong associate of the American and Canadian institutes.

The Mexican Outlook.

In Mexico there is one party; it is called the party of re-election. It has been said that in Mexico there is no public opinion; in Venezuela there is active public opinion, which has recently been expressed with peculiar emphasis. This shows the difference between two kinds of rulers. Castro was a dictator and so is Diaz, but one was a shameless tyrant, and the other is a beneficent guardian of the welfare of his people. Venezuela, with ruined credit, found herself driven to ridiculous dependence on fine-spun legal technicalities and shifty diplomacy to keep foreign nations from making justifiable reprisals; Mexico enters the financial markets of the world and freely borrows money for the greatest irrigation plan ever projected by any government, and her national railway merger bonds are oversubscribed. Venezuela was a steady defaulter; Mexico, April 1, promptly retired $10,000,000 of short-time gold notes issued by the National Railroad. President Diaz assumed the reins and proved himself capable of driving the coach of state; now his people insist upon retaining him in power.

In spite of this, the fact can not be blinked that opposition to the modern Cid Campeador exists in Mexico. The aspirations of Gen. Bernardo Reyes are well known. Younger men also look with longing toward Chapultepec. Circumstances might well arise which would embarrass the even course of administration, necessitating a show of force that would for a period restrain the influx of foreign capital needed for developing the resources of the Republic. In view of this, the failure of President Diaz to establish the government firmly in the hands of others while he himself is able to stand sponsor for the continuance of peace would be unfortunate. Perhaps he intends more than is generally known; the succession may be accomplished by means of resignation after the next election. That would insure a long tenure of the new incumbent without the risk of disturbing competition by opposing candidates for office.

The annual message to Congress was presented on April 1. In this President Diaz gives a picture of national progress and prosperity in the face of the business depression that demonstrates great financial vitality. The rate of interest has steadily declined during the year, manufactures are increasing, and the railway earnings denote a revival of activity. It is also pointed out that the increased quantity of exports compensated the shrinkage in market value of the commodities. At the same time the imports declined to such an extent as to throw the trade-balance strongly in favor of Mexico. The mining industry, however, has suffered severely from the troubled state of the metal market. The Government undertook to facilitate the resuscitation of the Cananea mines and smelter by conceding free entry for fuel-oil, and the result was so beneficial that the policy of encouraging the mineral industry by concessions permitting economical production is being extended.

Railroad development within the last six months has been important, bringing the United States into communication with Mazatlán by the prolongation of the Southern Pacific branch southward from Navajoa. The road from Guadalajara westward has reached Tequila, and in the north the line from Nogales is now completed to Del Rio. The length of the Federal railways is 11,825 miles, to which must be added 5007 miles of State lines, bringing the total to 14,832 miles. The President might have called attention to the fact of increasing development of mines, which has been conspicuous in Chihuahua and Jalisco. Capitalists have been taking advantage of the financial depression to purchase good properties on the 'bargain counter'. Recent activity in this direction has been remarkable. At the same time, rapid progress in the installation of hydro-electric power-plants has been an important feature. There has also been a growing demand for lands by colonists, and plans for exploiting enormous timbered areas in western Chihuahua and Durango have been made by persons supposed to represent Standard Oil interests. Manifestly capital is not fearful of political difficulties in Mexico. In spite of diatribes against the President and his administration, which find inconsiderate publishers and hysterical readers in this country, the men who have most to gain or lose are demonstrating in no uncertain manner their faith that dangers do not threaten the Republic which has been wrought by the wise statesmanship of Porfirio Diaz.

Eight Hour Legislation.

Under guise of police legislation the social revolution, so widely heralded, has made advance in several Western States. The example of Utah in limiting a day's labor in mines and around smelters, reduction works, and refineries, to eight hours, by a law enacted in 1896, was followed in 1903 by Nevada, and this year by California. The Nevada statute has been supplemented at the last session of the Legislature open-cut mining also. The stamp of approval was set upon the Utah statute by the United States Supreme Court in the case of Holden *v.* Hardy (169 U. S., 366), in 1897. This was carried up on a writ of error, and the right of the State Legislature to protect the health of the people was fully sustained. The exceptional nature of employment in mining and smelting was affirmed, the contention being that dust and gases present in both occupations exposed the operatives to unusual peril, and that lessening the hours of labor served a purpose bene-

ficial to the public by reducing the time of exposure to these influences. Conceding the utility of this restriction, it follows, and was so held by the Court, that no class legislation was involved in the discrimination between the operations of mining and metallurgy and other forms of industry. The decision maintained that inequality exists between employers and operatives, resulting in compulsion from which the laborer could not escape without undue hardship and financial loss, and that the enactment of legislation to protect him from unnecessary exposure to health was in the interest of the welfare of the State. The right of contract was held to be unimpaired by the drastic provisions of the law, which made it a misdemeanor for anyone to be employed under any agreement or pretext for a greater consecutive period than eight hours in the situations mentioned. The State is, accordingly, acknowledged to possess the power of restricting the acts of individuals when such curtailment of liberty is in the interest of the public.

It will be seen that the only evasion possible is to contract for piece-work. This could be done either by individuals, or by an association of persons, who would perform the work under contract by their own unaided labor. The legal restriction is upon the employment of operatives, not upon labor itself. Actually the restriction becomes general because of the impossibility of conducting extensive operations without the hiring of laborers, and furthermore because the labor unions have placed the ban on contracts. It must be observed that the Supreme Court, in Holden *v.* Hardy, distinctly reserves its opinion on the constitutionality of State statutes restricting hours of labor in general, where no question of health and safety was involved.

The Utah statute was devised to apply the eight-hour principle under cover of police regulation. It was so well done that it passed review by the highest tribunal in the land, in consequence of which other States may follow in the same course without fear of reversal. The Nevada statute was upheld in the State Court, and presumably that was considered final, as no appeal was taken to the United States Supreme Court, and there seems to be no doubt that the constitutionality of the California law would likewise be sustained. The action of the Nevada Legislature this year in extending the restriction to open-cut mining has passed beyond the ground confirmed by the Supreme Court, raising a question to be determined through further litigation. The real purport of the legislation stands clearly revealed. The doctrine is emerging from underground to assert itself broadly in the open air. It is, in effect, a part of the great social revolution of the age. We do not decry it; the body politic can not stand still while momentous industrial changes are taking place. The evolution of industry in one detail necessitates maintaining the equilibrium by changes in another.

There must be compensations; if shorter hours are demanded the pay must be measured according to the service. There are many mines in California capable of paying fair wages and reasonable profits when operated on the old standards, that must close if the labor unions insist upon the nine-hour wage for an eight-hour day. The law says nothing as to what the laborer shall receive, but it has precluded the miner from working longer than eight hours per diem. If he finds less work to do he will have to obey the law of supply and demand and reduce his price, or else he must secure the repeal of the statute. We would be glad to feel that reason will prevail, and that local unions will take cognizance of local conditions in adjusting the scale of wages, bearing in mind that the principle of charging 'all the traffic will bear' spells ruin to industry.

The Supreme Court in its findings has by implication affirmed, furthermore, that the laborer has a right to his job; that he is in the weaker position, and hence that the law may extend a shield over him and insure his tenure as against the necessity of grappling with the alternatives of prejudicing health by injurious employment or of abandoning his position. The old doctrine, rudely expressed in the phrase 'if you don't like the work, move on,' is denied by the terms of the decision which has validated this form of the eight-hour movement. This is a step in advance of the great Teacher of the broader socialism who said, "Is it not lawful for me to do what I will with mine own?" Apparently not. The authority of the Supreme Court is unquestionable, and it is interesting to see how the thought of its learned judges is molded by the tendencies of the epoch. We confess inability to follow the reasoning which attributes to mining and metallurgic work such exceptional unhealthfulness. Personally, we do not believe that the peril of silicosis in a gold mine is greater than the danger of infection by many diseases from the street-dust we complacently tolerate in our cities; we would prefer the risk of the miner to that of the motorman or city teamster. The dust of the smelter is no more dangerous than that of a cement mill; if we must discriminate along such lines the time-honored lustiness of the blacksmith may be regarded as a poetic myth. The gases of a smelter, to be sure, are dangerous, especially when they contain lead or arsenic, as they usually do, and there is reason for insisting on protective measures. Not only may hours of labor in such places properly be reduced to a minimum, with wages sustained on a level commensurate with the danger, but more exacting requirements for eliminating gases than is now customary might come within the purview of the law. Frankly, we do not believe that the eight-hour laws as applied to mining and metallurgic works in general are justified by any exceptional danger to health involved. If such were the purpose of this legislation it should not sweepingly include all classes of reduction works, as has been done in Utah, Nevada, and California. No one can pretend that a stamp-mill is an unhealthier place in which to labor than a machine-shop, a brick-yard, or a flour-mill. The odds may easily be the other way. Beneath the technicalities the essentially discriminative character of the legislation is plainly visible to straight-thinking men. The real question is a shorter day's labor for the workingman, but it were wiser to fight it out fairly on its merits, or else to construct police regulations operating equitably on a basis not limited to single industries.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. W. Mercer is at Denver.

F. L. Bosqui is at Madrid, Spain.

Raymond A. Linton was in San Francisco.

Joseph H. Shockley of New York is in the city.

H. L. Swain, of Mexico City, is here on a visit.

W. B. Winston has gone to Shasta county, California.

A. C. Lane has been lecturing at Wisconsin University.

F. A. Leach, Director of the Mint, is in San Francisco.

C. S. Herzig expects to go from Nicaragua to Montana in May.

G. H. Garrey has been examining mines near Mapami, Durango.

C. W. Hayes and David T. Day are in Mexico examining oilfields.

Juan Felix Brandes has returned to London from Mexico and Colorado.

Ernest V. Orford is general manager of the De Lamar mine in Idaho.

Falcon Joslin is in New York. He will soon return to Fairbanks, Alaska.

F. P. Mills is the new manager of the Giroux copper mines at Ely, Nevada.

C. Baring Horwood is manager of the North Randfontein mine, near Johannesburg.

S. F. Shaw has moved his office from Pasadena to 821 Central Bdg., Los Angeles.

Bailey Willis, of the U. S. Geological Survey, is lecturing at the University of Chicago.

S. A. Dockery is with the Mazapil Copper Co., at Concepcion del Oro, Zacatecas, Mexico.

Frank Jenkins has become assistant manager of the El Oro Mining & Railway Company.

G. C. Klug has been appointed manager of the Great Fingall mine, in Western Australia.

Richard Hamilton has been elected president of the Australasian Institute of Mining Engineers.

Carlos W. Van Law has closed an engagement with the Guggenheims, and has moved to New York.

Alfred F. Main succeeds R. M. Raymond as general manager of the El Oro Mining & Railway Company.

Willis Lawrence is superintendent for the Sierra Morena Mining & Refining Co., at Paso Robles, California.

Godfrey Doveton has completed testing the mills of the Guanajuato Development Co., and has returned to Mexico City.

Frank Goodman has resigned from the Ohio Copper Co. to become general manager for the Montreal Co. in Wisconsin.

H. E. West is returning to El Oro, Mexico, having accepted an appointment with the El Oro Mining & Railway Company.

Frank W. Oldfield was in San Francisco after an extended trip through Jalisco and Chihuahua. He has gone to Tuolumne county, California.

R. M. Raymond has resigned as general manager of the El Oro Mining & Railway Co., to become managing director, with residence in the City of Mexico.

J. W. Woodford, during the past four years superintendent for the Princeton M. & M. Co., of Dolomi, Alaska, has become general superintendent for the Iron Mountain Tunnel Co., at Superior, Montana.

J. H. Van Amringe of Columbia University was the recipient of a loving-cup from the alumni of the School of Mines on April 3, the occasion being the anniversary of his birth, and at the close of a half-century of teaching.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, April 15.

Antimony	12—12¼c	Quicksilver (flask)	44—45
Electrolytic Copper	15¼—16½c	Spelter	6¼—7c
Pig Lead	4.40—5.35c	Tin	32—33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 8. £ s. d.	Apr. 15. £ s. d.
Camp Bird	0 18 3	1 2 9
El Oro	1 5 0	1 5 0
Esperanza	2 17 6	2 17 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 10 3	0 10 6
Mexico Mines	5 12 6	5 7 6
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 9	12.57	4.10	4.84	50⅞
" 10	12.67	4.10	4.86	50⅞
" 11	Sunday.	No market		
" 12	12 57	4.10	4.86	50⅞
" 13	12 57	4.15	4 90	51⅛
" 14	12.57	4.15	4.98	51⅛
" 15	12 57	4.15	4.98	51⅛

MINING QUOTATIONS—NEW YORK.

	Closing Prices. Apr. 8.	Apr. 15.
Amalgamated Copper	76⅞	76¾
American Smelting & Refining Co	89⅝	88⅛
Boston Copper	11⅞	11⅝
Butte Coalition	24¼	24
Cumberland-Ely	7¾	7⅞
Dolores	6	5½
El Rayo	2¾	3
Giroux	8	8
Greene-Cananea	10⅛	10½
Indiana Sonora	3¾	3¾
La Rose	6⅝	6¾
Miami Copper	14½	14⅝
Nevada Consolidated	20⅝	20⅛
Newhouse	3⅜	2⅞
Nipissing	10¼	10⅜
Ohio Copper	6⅛	6⅜
Tennessee Copper	41¾	41½
Utah Copper	43¾	43¼
Yukon	4¼	4⅜

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. April 15.		Closing Prices. April 15.
Adventure	8¾	Mass	9⅛
Ahmeek	160	Mohawk	61
Allouez	38¾	North Butte	68¾
Arcadian	4¾	Old Dominion	51½
Atlantic	11	Osceola	129¾
Calumet & Arizona	100	Parrot	33¼
Calumet & Hecla	605	Santa Fe	2
Centennial	30½	Shannon	14⅜
Copper Range	77⅛	Superior & Pittsburg	13⅜
Daly-West	10	Tamarack	69½
First National	6⅛	Trinity	14
Franklin	15	United Copper Con	12¼
Granby	96	Utah Con	39¼
Greene-Cananea, ctf	10½	Victoria	4½
Isle Royale	24	Winona	4¾
La Salle	14½	Wolverine	143

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, April 15.

Atlanta	$ 15	Midway	$ 31
Belmont	95	Montana Tonopah	70
Booth	23	Nevada Hills	1.30
Columbia Mtn	16	Ophir (Comstock)	1.15
Combination Fraction	1.15	Pittsburg Silver Peak	60
Daisy	45	Rawhide Coalition	40
Fairview Eagle	20	Rawhide Queen	40
Florence	3.40	Round Mountain	79
Goldfield Con	8.35	Sandstorm	15
Gold Kewenas	18	Silver Pick	31
Great Bend	19	St. Ives	14
Jim Butler	16	Tonopah Extension	50
Jumbo Extension	23	Tonopah of Nevada	6.90
MacNamara	31	Tramp Con	4
Mayflower	11	West End	31

General Mining News.

ARIZONA.

GILA COUNTY.

At the Eureka property, which was recently merged with the Globe Consolidated, preparations are being made to sink a shaft. A good deal of preliminary work, such as road building and grading has been done. The Eureka adjoins the Miami on the south and is believed to carry the same character of ore. There is also a strong vein of carbonate and oxide ore which has been opened to a depth of 40 ft. The Cordova Copper Co., which is the name of the re-organized Globe Consolidated, has made preparations to sink the Gem shaft 400 ft. deeper, which will give it a depth of nearly 1600 ft., or about the same as the thirteenth level of the Old Dominion. A 3½-ft. vein of sulphide ore has recently been struck on the 1200-ft. level, which assays 6% copper, 38% iron, and 40% sulphur.——The Old Dominion is maintaining its output around 3,000,000 lb. per month while the price of copper remains below 13c. About 150 men have been laid off. Pumping in the mine has been largely increased by the unusually abundant spring freshets, and the five million gallons taken out per day may be utilized later for concentrating plants.

PINAL COUNTY.

The gold discovery announced two weeks ago as having been made by J. H. Bates and A. Sears turns out to be an excellent one. The exact locality is 7 miles north of the old Peter Winkelman ranch, now known as the town-site of London, and immediately north of the property of the London-Arizona Mining Co. The vein is between 9 and 10 ft. wide, and extends through 10 claims.



North Bloomfield.

YAVAPAI COUNTY.

Bert Thorne and H. L. Sweeney are developing a group of claims in Grapevine canyon, Black Hills. They have over 1000 ft. of work done on this group, and are now drifting on their Golden Gate claim. The ore is copper, showing gold and silver.

CALIFORNIA.

NEVADA COUNTY.

(Special Correspondence).—One of the richest strikes made in this district for many months has been recorded at the Central Consolidated mine at Banner Mtn. A strong vein of milling ore has been opened up, and this vein is traversed by a narrow streak of high-grade. The ore resembles that in the Idaho-Maryland. The company is arranging to push more extensive developments. Twenty stamps are dropping at present. C. N. Bailey is superintendent.——It has been decided to run four drifts, two east and two west, from the bottom of the 1100-ft. shaft at the Pittsburg mine. An order has been placed with the Taylor Foundry & Engineering Co. for the early delivery of an electric two-drum hoist with a capacity of 2000 ft. The new compressor will soon be in place and several machine-drills will be used. Mark B. Kerr is superintendent.——At a depth of 440 ft. an 18-in. shoot of good-grade ore has been encountered in the Montana mine in Willow valley. The vein is supposed to be a continuation of the rich shoot formerly worked in the old levels. W. G. Brown is superintendent.——The new mill at the Giant King mine is rapidly nearing completion. Considerable development work is under way and a large reserve of milling ore has been opened.——The pumps at the Lecompton are again in action. The mine has been idle since last January. Samuel Colt is superintendent.——It is reported that the Morning Star and Badger Hill mines in the Cherokee district will be shortly re-opened and operated on a comprehensive scale. A number of properties in this district, including the well known Siberian, are attracting attention.——Considerable placer mining is going on at various points as a result of the heavy rains of the past winter. Many old hydraulic mining towns, such as North Bloomfield and North San Juan, eloquently testify to the former importance of the placers in Nevada county, now almost a memory of the past.

Grass Valley, April 12.

A 7-ft. vein carrying gold has been found at Chicago Park during development by the Golden State Mining Co. Two feet on the hanging wall side is oxidized, free-milling, and plentifully sprinkled with gold. The remainder is not so valuable, containing, however, abundant sulphide. George A. Shebley, the principal owner and manager, has a 4-stamp mill operated by water-power. The discovery was made through an upper adit, but another about 200 ft. lower down is now in 300 ft., and will be advanced forthwith to intersect the new vein.——The strike made by E. H. Wilson in the Sixteen-to-One mine near Alleghany, nor far from the famous Tightner, is the most important of some months in the vicinity. It is stated that since April 1 no less than $20,000 has been extracted.——The Nichols mine, a mile west of Grass Valley, is to be re-opened by the California Expolration Co., a new company, organized under the laws of Arizona. Oscar Coflin, F. D. Mitchell, and G. H. Hellman are representatives of the company now engaged in examining the property.

PLACER COUNTY.

Twenty men are working at the Jupiter mine. The richness of the channel, like all others, varies in value, but so far not a barren spot has been found. A crew is at work opening the Big Dipper lead, where Mr. Rose, the superintendent, has found good gravel.——The site for the new compressor at the Annie Laurie has been prepared, and the compressor itself has arrived. Two carloads of other material are at Weimar awaiting shipment to the mine. The shaft on the Annie Laurie is 32 ft. deep, and carries gold at every point developed.

SAN BERNARDINO COUNTY.

(Special Correspondence).—At a called meeting of the stockholders, held in this city on April 6, the officers of the Orange Blossom Mines & Milling Co. resigned, and new officers were elected. It has been decided to re-organize the company and endeavor to place it on a profitable producing basis. It is said that the new mill is a failure and that the property has been badly managed. The stock formerly sold at par, but is now down to 7c. It is estimated that 50,000 tons of $6 ore are in sight and with slight alterations to the mill can be treated for $3 per ton.——Conditions at the Orange Blossom Annex are far from satisfactory. The vein swerved from the shaft at the 60-ft. point and it will be necessary to run a cross-cut from the shaft in an endeavor to find it. Only three men are now employed.——Negotiations are under way for the sale of the Yellow Aster mine at Randsburg to a New York syndicate. It is understood that

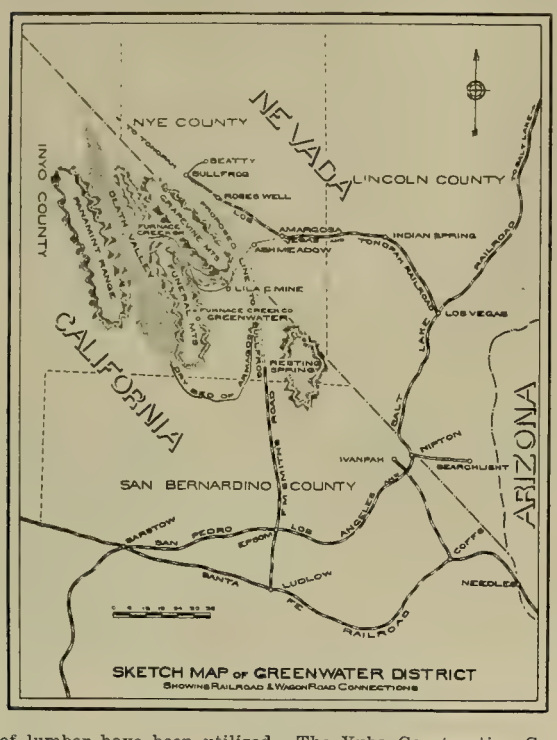
the consideration is $1,500,000. The property is held under an option by Albert Anchor.——At the Exchequer considerable milling ore is being broken and the mill is running continuously.——Considerable mining is going on in the Silver Lake district and several rich strikes are reported. This district was much in evidence two years ago, but the financial stringency caused a practical suspension of activities. Recently several companies have resumed work on the most promising mines and prospects.

San Bernardino, April 9.

Forty miles south of Needles and half a mile from the Colorado river, A. S. Munn has taken up 76 claims, on which there is said to be abundant nitrate of potash. If this be true the deposit should be of considerable importance.

SHASTA COUNTY.

The dredge belonging to the Shasta Dredging Co. has progressed so far that the hull is now ready for launching. Contrary to custom, the hull has been built on solid ground, instead of in a pit. Forty men are at work, and 200,000 ft.



SKETCH MAP OF GREENWATER DISTRICT
SHOWING RAILROAD & WAGON ROAD CONNECTIONS

of lumber have been utilized. The Yuba Construction Co. is doing the work under contract, for the price of $120,000. ——The Clipper and Croesus mining groups were transferred last week from Alfonso di Nola and Henry J. Wicker to the Carnegie Mines Co. for a consideration of $140,000. The purchasing company was incorporated in California March 16, with a capital of $2,000,000. George H. Cross, of San Francisco, is president of the company, and Alfonso di Nola is vice-president.

The Mammoth plant of the U. S. Smelting, Refining & Mining Co. at Kennett is now operating to full capacity, treating a tonnage of 1700 tons of ore daily. This company now has a payroll of 1000 men. It is planning an additional expenditure of $50,000 upon its smelter, in widening its crane track and other improvements.

TUOLUMNE COUNTY.

From the rich strike recently made in the App mine at Quartz over $50,000 was extracted in a few days. The extent of the orebody is not yet known. The ore is yellowish gray in color.——It is probable that an Eastern company will secure control of the Floyd mines, which are owned by J. L. Gibbs, of Tuolumne.——The New Aurum Mining Co., of which L. D. Rogers, of Los Angeles, is general manager, is increasing the crew employed at its mines on Hunter creek, and this week started up the mill. A carload of rails has been purchased and will be used in constructing tracks from the Hunter and War Eagle claims to the mill.——The True Business and Horse Shoe mines, situated on Knight's creek, and owned by Senator J. B. Curtin and others, have been bonded to H. W. Gendar and H. M. Wetherbee.——One hundred men are employed at the mines in the vicinity of Soulsbyville—50 at the Soulsby, 30 at the Black Oak, and 20 at the Draper.

COLORADO.

CLEAR CREEK COUNTY.

Two feet of solid galena were uncovered last week in a stope on the sixth level of the Mineral Chief. Tests show 55% lead and from 60 to 70 oz. silver per ton. There is also exposed a body of milling ore that is about four feet wide. The aerial tramway has been brought into use in delivering the product to the 50-ton mill. The compressor plant recently purchased was put into commission last week, and machine drills are now being used. C. E. Pughe, the manager, expects to complete the raise from the sixth to the fifth level within 30 or 40 days.——The Alice Gold Mining Co. has a force of men at work extending drifts in the big dike of the Alice mine. Work on the 300-ton milling plant will be put under way as soon as weather conditions permit. A. H. Roller of Idaho Springs is manager.——Grading is in progress for a transformer house at the Gold Hammer mines on Donaldson Mtn. Temple electric drills have been ordered and are to be installed without delay. B. J. Martelon is manager.——T. I. Slater, manager of the Gold Anchor mine and mill at Alice, is unwatering the mine workings, and during the next ten days the new mill will be started on its second run.——The Michaelson system of ore-dressing is to be installed at the Gold Dirt mine, owned by the Empire T. Co. It is understood that the company controlling the Michaelson patents has made an offer for a 10-year lease upon the property and that a 200-ton plant will be erected.

LAKE COUNTY.

The Grand View vein, which was struck last week in the Granite tunnel, is found to be about 10 ft. wide, and to assay $15 per ton. Near the hanging wall is a small streak which carries several ounces of gold per ton. Arrangements are being made to install a new air-compressor.

SAN JUAN COUNTY.

The Crown Point Mining, Milling & Power Co., under the management of George C. Franklin, is pushing work both in the mine and mill at the Suffolk property near Ophir. Thirty men are now employed, one-half in the mill, and the remainder underground. It is intended to put up 40 stamps, and 20 of these are almost in place. Pipe-lines, the flume, and the Huson tramway are also being put in shape, and Franklin hopes to have the whole in operation some time in May.——Concentrates have been accumulating around Silverton owing to the snowstorms. Shipments have now been made to the extent of 7175 tons, of which the Gold King shipped about 5000, and the Hercules 1025. No crude ore has yet been sent out, but this month it will add to the shipments of concentrate to the Durango smelter.—— The Animas Power Co. went into the hands of receivers some time ago with an indebtedness of $1,350,000. The Standard Trust Co. of New York held the trust deed against the company's property and effected a sale of its affairs. The holding was bid in by a re-organization committee.

SUMMIT COUNTY.

The Wellington mill at Wellington is now completed and is said to be successfully treating ore from the mine of the same name. It was built by J. J. Seaman.——The new Reiling dredge has started work in French gulch below the Reliance dredge. It is operated under the general managership of H. J. Reiling, and is superintended by F. Z. Hunt.

TELLER COUNTY.

At the directors meeting of the Portland Gold Mining Co. the regular quarterly dividend was declared, but at the rate of 3c. instead of 4, as formerly. The reduction is said to be for the purpose of holding a reserve for mill construction. By next meeting the directors will have decided the

capacity of the plant to be installed. The Clancy process will be used, thereby obviating roasting.——Union Leasing Co. has beaten its record by shipping 97 carloads of ore during the month of March. This is an exceptional production for the company, and is due to an accumulation, as is shown by the fact that there are only 65 miners on the company's payroll.

IDAHO.

IDAHO COUNTY.

Richard A. Kleseattle, manager of the Black Diamond Mining Co., operating at Dixie, announces that a 10-stamp mill will be erected on the property the coming summer. The company has been running a 4-stamp mill since October. In the meantime developments have proved so satisfactory that it was decided to increase the mill capacity.——At least a dozen placer mines will be working this summer in central Idaho, and numbers of owners have effected improvements. The Golden Rule has had its volume of water greatly increased by enlarging the new 8-mile ditch. The Cook brothers have put in new flumes along the ditch that supplies their Gold Hill placer. Buffalo Hill, owned by Butte men, with J. M. Anderson as manager, has bought an elevator, which will be installed early in the summer. Pete Erickson has made some improvements to his equipment on Little Elk. At Newsome the Leggett Creek Co. is adding hydraulic machinery, as is also the Donforth property in Dixie.

SHOSHONE COUNTY.

Development on the La Blanche property on Pine creek has been started, and a contract for a 1500-ft. adit has been let to McDermott & Batterton of Kellogg. This will give a depth of 1000 ft. below the upper workings. There is some talk of equipping the mine with machinery, but no action has yet been taken.——The trouble which the Missoula Copper Co. has been having with its diamond-drill prospecting now appears to be about ended, and an advance is being made of 15 to 30 ft. per day. In the first hole a heavy water flow up to 170-lb. pressure was tapped. This is diminishing, but the flow in the other hole is increasing. The heavy pressure of water prevented securing a core, but the cuttings assayed 1.6% copper.——A contract for 100 ft. has been let to John Page on the Liberty group of claims in the Lookout district. This will tap the vein at a depth of about 50 ft., when drifting will be commenced.——A small force of men has been set to work clearing out the workings of the Stewart mine at Wardner. It is believed that this is the first step toward a resumption of development. F. Augustus Heinze, the principal owner, is expected to visit the mine during the present month and in the meantime a detailed report will probably be made on the workings by one of Heinze's engineers.——The Bunker Hill & Sullivan Co. has declared a dividend of $60,000 for the month of April. This is a reduction of $15,000 on the regular dividend, due to the low price ruling in the lead market. The company has now paid out $10,986,000 to date. ——A report states that fully 7½ ft. of shipping silver-lead ore has been exposed in the shaft being sunk in the Josephine mine. Good ore is also showing in the upper workings. The shaft is down about 105 ft.——Work has been resumed at the tailing plant of the Mitchell Concentrating Co. in Wallace. For some time past a series of experiments have been conducted, and it is believed that the plant has now been put in good condition. Work has been started with two vanners and five tables. It is believed that a profit of about $120 can be made per 24 hours. ——Twenty men will be set to work on the Paragon Consolidated property to continue the lower drift, and at the same time to drive a 600-ft. raise from the No. 3 level. The question of erecting a mill has been under consideration, but no action will be taken yet.——The No. 1 oreshoot has been encountered in the property of the Hennessy-Burns mine at Burke. The depth was between 70 and 80 ft., and 2½ ft. of quartz and galena have been exposed. The men have now been set to drive for the No. 2 lode, which is about 100 ft. ahead.——Announcement is made that a 2-compartment shaft 400 ft. deep will be sunk on the Butte & Coeur d'Alene Mining Co.'s property near Mullan. The shaft has been equipped with an electric hoist and compressor plant, which will be in operation as soon as connection can be made with the wires of the Washington Water Power Co. James E. Quinlan is president of the mining company.——The Caledonia mine near Wardner, has entered the list of shipping properties. A carload of ore has been prepared which will run from 8 to 40% lead and 100 oz. silver. Twenty-four men are at work on the property. A shaft to be sunk to the 500-ft. level is now down 450 feet.

MICHIGAN.

Last year the Tamarack Mining Co. milled 654,900 tons of 'rock' at its 5-head stamp-mill. There was a decrease in the yield of refined copper, amounting to 1.2 lb. per ton stamped. This was chiefly owing to treating a larger tonnage of low-grade ore from the developments on the Osceola amygdaloid. Recently some of the richest 'rock' ever disclosed in the mine was broken in the breast of the eighteenth level in No. 3 shaft, and still continues good.

MONTANA.

BEAVERHEAD COUNTY.

Certain ground in the neighborhood of Argenta is considered to be of value for placer work, and L. D. Tibbetts, of Argenta, states that drilling machinery has been ordered for testing its value.

MISSOULA COUNTY.

The big cyanide plant, which was ordered some time ago for the French Bar Mining Co. operating a group of claims close to the Idaho boundary, has now been delivered at the property and is being installed under the supervision of John Lacasse. Henry Kuphal has been appointed chief engineer, and will survey the different veins of ore recently opened up in the mine.

SILVER BOW COUNTY.

The Butte Coalition Co. is gradually increasing its output, and the new levels in the Minnie Healey and Rarus mines are opening well, a lot of new ground being developed. The output now averages about 1400 tons of ore per day. The company at present is engaged in running a cross-cut from the Rarus 1700-ft. level to the Tramway shaft, and connections will be made before the Tramway station is cut. The 1600-ft. level in the Minnie Healey is just getting into the orebodies, but stoping is only being done on the 1400 and 1500-ft. levels. The cross-cut from the Rarus to the Tramway shaft will be completed within the next three weeks. The new levels of the Tramway are the 1700 and 2000-foot.

NEVADA.

CLARK COUNTY.

The Empire Gold Dredging Co. of Los Angeles has bought a Lidgerwood bucket dredge with a daily capacity of 1000 cubic yards, to operate 300 acres at Las Vegas Wash, on the Colorado river. The company also owns a lot of dredging ground at Laguna Dam, in Yuma county, Arizona. H. J. Meyer, the secretary, says the gravel runs from 15 to 50c. per cubic yard, with an average of 25c., and estimates his costs at 6½c. The company's other officers are A. B. Call, J. R. McDonald, and D. F. Doggett.

ESMERALDA COUNTY.

The ore output of the mines and leases of Goldfield district for the past week amounted to 6930 tons, valued at $507,850, and was the second largest yield in the history of the camp.——Forgeries of Florence company stock on an extensive scale have just been brought to light by the receipt for transfer at the company's office of a certificate for 2500 shares, which officials of the company pronounce to be spurious. The certificate is printed on an exact duplicate of the stock certificates of the Florence compnay, and purports to have been issued to Arthur W. Bikker, Jr., at present living at Redwood, California. A bungling forgery of the signature of T. G. Lockhart is a striking feature of the spurious certificate, but the seal is also a poor imitation of the official one. Another feature is that where the genuine

certificates are punched with a safety check showing the number of shares for which they are issued, a rubber stamp is used on the forgeries.——The Consolidated company announces a new strike of ore 10 ft. wide and averaging $100 per ton in the Lucky Boy claim of the Jumbo, south of the Red Top. It has been opened up for 20 ft. Bullion to the value of $200,000 was shipped out by the Consolidated during three days or the same amount as was shipped during the last three days of last week.

The Orleans mine, also known as the Cottrell, at Hornsilver, is making good progress in the development of high-grade ore. The vein is 14 ft. wide, but so far the shaft has not been sunk more than about 60 ft.; however, a 25-hp. Fairbanks-Morse hoist is now about to be installed, and sinking continued to the 100-ft. point. Shipments of 200 tons have been made, and were paid for by the Nevada Reduction works at the rate of $127 per ton.——The Lucky Boy mine at Hawthorne is also doing well. The principal owners are John Miller and J. K. Adams, but most of the ore is being taken out by lessees, under the management of J. D. Hubbard. The shaft is nearly 400 ft. deep, and developments have been carried about 300 ft. in each direction in silver-lead ore worth $100 per ton.

HUMBOLDT COUNTY.

(Special Correspondence).—Samuel P. Harris, representative of the London syndicate which is constructing the mill in Seven Troughs, has arrived here and will remain until the plant is completed. D. H. Skae, the manager, believes he will have it ready in two weeks. The scale of charges is graduated from a minimum charge of $5 per ton.——The Fairview mine sent out a shipment of ore to the smelters instead of sending it to the local mills, on account of the high proportion of silver. It averages about $200 per ton. ——The Wihuja lessees on the Seven Troughs Coalition have sunk their incline shaft 375 ft., and are getting out excellent milling ore from a shoot in the Kindergarten vein. The heads average $65, which will be reduced by adding low-grade ore from the dump. The Merger lessees, working on the same property, have ordered a hoist and are about to sink a hundred feet. The Jess-Bard and Sandifer lessees, also on Coalition ground, have effected a consolidation, in order to obtain mutual advantages with respect to pumping.——Work has been resumed on the Potter-Arnett lease on the Mazuma Hills by the installation of a 50-hp. engine and a No. 7 Cameron pump. The engine will be run by steam, the first in the district, and a shaft will be sunk 300 ft. before any lateral work is done. The Mazuma Hills and Reagan veins will then be explored.——At the Farrell end of the district there is considerable activity. The Snowsquall has got free-milling ore on hand to send to the new mill; the Rico mine has developed three new veins; and on the Hero Nevada they are running an adit under the Hillsite shaft where they have got into a 10-in. streak of shipping ore.——The Caesar tunnel is now in 150 ft. After 750 ft. have been done three veins will have been cut, the showings of which on the surface are distinctly valuable. Just below the Caesar, the Three Wills Co. has also opened three veins, and the middle one assays $70 per ton. A shaft will be sunk on this middle one to develop them all.

Mazuma, April 12.

NYE COUNTY.

The total output of the Tonopah mines for the past week was 5841 tons, of an estimated value (the shipping ore being valued at $60 a ton and the milling ore at $25 a ton) of $146,025. The Tonopah company sent 3150 tons, the Belmont 950, the Montana-Tonopah 961, the Midway 200, and the MacNamara 300 tons.——The Tonopah Mining Co. broke 457 ft. of new ground during the week, and lowered the 3-compartment Mizpah shaft down to 1323 ft. The bottom of this shaft shows no change, being still in dacite.——At the Belmont all repairs on the surface have been completed, and everything is ready for churn-drilling from the 1000-ft. level.

WHITE PINE COUNTY.

The Nevada United Mines Co., which now has control of the old Martin White mine at Ward, 18 miles south of Ely, has a big tonnage of ore blocked out that will sample 15% lead and 15 oz. per ton in silver, and running high in iron. The men in control of the company are Franklin Guiterman, H. B. Northrup, Walter G. Boyle, J. B. Grant, W. O. Temple, and J. A. Snedaker, all of Colorado. It is reported that this company is trying to persuade the Nevada Northern to extend its line from Ely to Ward. Mr. Guiterman and Mr. Grant are closely associated with the smelting interests of the Guggenheims in Colorado, and the latter dominate the affairs of the smelter and railroad at Ely.——The Amalgamated Nevada Mines Co., whose interests are in charge of J. H. Marriott, of Osceola, has had 12 men employed during the past winter on the San Pedro and Mabel properties at Black Horse, 9 miles northeast of Osceola. The company has placer holdings on Dry creek, at Osceola, which are under lease to miners who have been tunneling and drifting in the gravel beds all winter, piling up placer dirt to be washed with the freshet of water that comes with spring weather. The Amalgamated company is also employing a few men on Baker creek, laying a pipe-line to carry water to operate an electric generator.——The St. Lawrence mine, in Snake range, 18 miles south of Osceola, has employed 6 men during the winter, developing a body of lead ore, much of which samples 40 to 60% lead and 40 oz. silver per ton. F. C. Williams is manager, Orson Hudson being in charge of the work. It is opened by an adit that has been driven 400 ft. on the vein. By extending it farther a depth of 300 ft. will be gained, as the mountain at this place rises abruptly to that height. It is planned to erect an aerial tramway from this mine to the valley below, requiring a line 2 miles long.——J. H. Marriott has partly developed a tungsten mine in Wheeler's Peak, 8 miles south of Osceola. The tungsten ore occurs in a vein between granite walls, the white quartz gangue carrying 8 to 10% tungsten. His plan is to put up a small plant for concentrating the ore.——The Veteran shaft of the Cumberland-Ely has a double-drum electric hoist, operated by a 300-hp. motor, running 400 r. p. m. The winding speed of the hoist is 500 ft. per minute., and it is now operating two 5-ton skips to a depth of 480 ft. The latter are loaded and dumped automatically. The shaft is 8 by 24 ft., with two compartments for skips and one for a cage to carry the men. The cage is operated by a steam hoist.

During March the Nevada Consolidated and the Cumberland-Ely shipped 3,805,259 lb. of copper, of which the former company produced nearly 60%. The total amount shipped by both companies since the beginning of the year is 8,618,969 pounds.

NEW MEXICO.

SOCORRO COUNTY.

The Mogollon Gold & Copper Co. has been re-organized and, it is said, will soon resume operations on a large scale. The new officers of the company are: Frederick M. Seward, of Goshen, New York, president; W. H. Royce, of Middletown, New York, vice-president; and Frank P. Jones, of Silver City, treasurer.——A large amount of machinery is being hauled out to the gold camps of the Mogollon Mtn., and the copper camps of the Burro mountains.

GRANT COUNTY.

For the first time in over a year there is plenty of water for placer mining in the Pinos Altos district. About 100 men are at work washing dirt, averaging from $3 to $4 per yard.

OREGON.

BAKER COUNTY.

Thomas Lammers and D. K. Evans, of Spokane, who recently inspected the Cougar property near Sumpter, are arranging for a resumption of operations. The dredging company owns several hundred acres of placer ground along Powder river, below Sumpter.

UTAH.

JUAB COUNTY.

The Opex Mining Co. has extensive holdings in the neighborhood of the Centennial-Eureka, Grand Central, and

Mammoth mines, the stockholders therein being Jesse Knight, F. A. Heinze, Samuel Newhouse, F. P. Swindler, and others. As the initial step in thoroughly exploring and prospecting this territory at the necessary depth, the company, under Swindler's direction, has sunk a 3-compartment shaft to a depth of 2000 ft., and this sinking is to continue 500 ft. deeper. Each compartment is 4 by 4½ ft., two for cages and the third for a man-way. The shaft is timbered in the best fashion and stations have been cut at 1000, 1300, 1500, and 2000 ft. The hoisting is done with a 14 by 20 double-drum hoist, of Hendrie & Bolthoff make, a special steel 1-in. cable being used. In the 28 days of February 186 ft. of sinking was done. Swindler states that the cost of sinking the 200 ft. has averaged $45 per foot; that the cost of powder used has averaged $3.49 per foot. The cost of equipment and the installation of same amounts to $30,000.

The directors of the May Day Mining Co. have been elected for the ensuing financial year, and include John Dern, W. S. McCornick, James Chipman, M. P. Braffet, and M. S. Nielson. During the year ending March 31 the company sold 5218 tons of ore for $89,192, 1768 tons of concentrate for $44,027, and paid out $44,000 in dividends.——The Schwab Mining Co. will operate the Agnes, East Point, and New Idea claims in the eastern end of the Tintic district. The officers of the company are Samuel Schwab, John Roundy, and S. Brockbank.——The Zuma Mining Co. has raised enough money to continue its development of six claims in East Tintic. Electric power has been obtained from the Telluride Power Co., and there is ample equipment at the mine. C. F. Kratzer, of Wallace, Idaho, W. S. Garity, and Rasmus Nelson are the principal owners.

SALT LAKE COUNTY.

The new silver-lead orebody on the 700-ft. level of the Day mine of the Nevada-Utah Co. is now proved for a width of 130 ft. without reaching the wall. This orebody has been opened to 20 ft. above the 600-ft. level and it is just as good grade as where first encountered on the 700-ft. It has also been cut on the 800-ft. level. Most of this ore assays 20 to 40 oz. silver and 10 to 15% lead.——The Utah Consolidated Copper Co. treated 248,200 tons of sulphide ore at the Garfield smelter in 1908, yielding 10,648,200 lb. copper, 265,284 oz. silver, and 23,440 oz. gold. The company's smelter at Murray is to be dismantled, and shipments will be made to Tooele when the contract with the Garfield Smelting Co. comes to an end in April 1910.

WASHINGTON.

FERRY COUNTY.

Development is progressing at the First Thought mine near Orient, where P. Burns owns 80% of the property. E. E. Alexander, of Spokane, who recently inspected the mine, says the orebody is 120 ft. wide at the surface, while at the 300-ft. level it is 500 ft. wide. Thirty-five men are employed, and a yearly tonnage of 14,000 has been shipped over three miles of aerial tram to the Great Northern railway to Northport and other smelters.

The Phoenix Gold & Copper Mining & Milling Co. is operating on a group of seven claims on Cecil D. Mtn. An immense vein traverses three claims the full length of 4500 ft. From a number of samples taken the ore assays from 3 to 15% copper and from $2 to $10 gold per ton. One shaft is down 80 ft. and another is down 20 ft., and there are also several open-cuts. George Ilse of Spokane is the president and general manager and Geo. B. Dean is superintendent.

OKANOGAN COUNTY.

The Peerless Mining Co. has driven an adit into Little Mount Chopaca over 400 ft., the last 60 ft. having penetrated an orebody which assays in gold, silver, and copper up to about $80 per ton, and contains traces of platinum.——The Nighthawk mill has made a satisfactory three days run with 10 stamps, and the full battery of 20 stamps is now in operation, but it is uncertain if it can be kept running continuously on the limited quantity of ore blocked out.——The Free Gold mine, idle for ten years, has been acquired by the Owasco, a new Eastern company. It is situated on the Similkameen river, west of Oroville. A 10-stamp mill goes with the mine. A new manager has arrived, and steam will be replaced by electric power. The mine was formerly a good producer of gold ore.

STEVENS COUNTY.

Operations will soon be resumed at the Globe mine, on Toulon Mtn. An aerial tramway is under consideration, to convey the ore three miles, to the Spokane Falls & Northern railway at Orient.——The machinery has been repaired and new buildings have been erected and work will shortly be resumed on the Jay Gould mine, under the management of the Travelers Mining Co. F. C. Bailey of Chewelah is superintendent.——An adit has been driven on the Tungsten King mine, near Deer Park, which has tapped a vein from which 1000 lb. of wolframite was extracted in one day.

CANADA.

BRITISH COLUMBIA.

The Donald Copper Co. is steadily developing the Bruce group, three miles west of Midway. Two shifts under the direction of J. D. Graham have driven 380 ft. of adit, and also a considerable amount of surface work, developing what is considered a promising body of copper-bearing ore. It averages 5% copper and carries $6 per ton in gold. These claims were taken over last July from S. M. Johnson and J. C. Haas, the latter of whom has been retained to superintend the operations of the company. J. H. Tilsley is president.——A mill is being erected at the Jewell mine to try out a new method of separating gold from the tailing. It is an invention of H. G. Nichols, manager of the Ymir mine, and the Slimes Treating Co. has been formed to promote its use.

ONTARIO.

Official figures show that the ore shipped from Cobalt in 1908 contained 19,394,496 oz., valued at $9,112,746, and the by-products of cobalt and arsenic brought the total value for 1908 up to $9,229,768. The Gowganda and Montreal river silver camps are detracting attention from Cobalt, although almost nothing has yet been done there. Yet in the Cobalt district thousands of acres of mineralized land in Coleman and Lorrain townships have not even been prospected. Cobalt Central has 777 acres, all mineralized. Of this big acreage, only four acres have as yet been developed in two years operation. Nipissing has 840 acres, of which less than 20 acres have been opened up after five years work. La Rose is working in only one corner of its big acreage. The same is true of all the companies with extensive holdings.

MEXICO.

COAHUILA.

R. U. Atkins, representing the Mexican Coal & Coke Co., has announced that the company has found a fine seam of coal 8 ft. 8 in. thick in the No. 8 shaft at Las Esperanzas. The coal is of excellent coking quality. E. R. Jones and E. Ludlow are the managers.

GUERRERO.

Many pertenencias have recently been denounced in the neighborhood of Placeres del Oro. Fred McFarlane, of Portland, is reported to be bringing in a 20-stamp mill for treating a good vein he owns eight miles northwest of Placeres. The Fortuna mine has been sold to R. Buchanan and L. W. Stover, who have taken up other claims round about. An *antigua* in the Rio Frio country has been cleaned out by J. M. Barry. It has obviously not been worked for a long time, but assays of the vein have shown that it is worth development.

SONORA.

The Greene Cananea Copper Co. turned out an even 2000 tons of copper during the month of March, together with 89,000 oz. silver and 520 oz. gold. At the present time a considerable amount of betterment and improvement work is going on at the property, a part of which is charged to the cost of production and the balance to construction account. In all, it is estimated that the expense of the improvement work going on is equal to 1c. per pound of copper now being produced.

Special Correspondence.

LONDON.

Rio Tinto Decreased Profits.—United Alkali Finances.—Broken Hill Proprietary.—Palmarejo.—Dolcoath.

The report of the Rio Tinto Co. for 1908, which has just made its appearance, contains information of special interest. The drop in the price of copper has affected both profits and dividends. The profit for the year was £1,230,133 and the dividends £1,108,437; the rate on the ordinary shares being 55%. Two years ago the profits were approximately double that amount, and the dividend 110%. Another point of interest is the increase in local output of copper. A few years ago additional smelting plant was provided, but owing to continued drought it could not be operated. This trouble is now past and the results are seen in increased production. The copper produced during the year by treatment at the mines amounted to 24,256 tons, as compared with 21,251 in 1907. For the last 20 years the production at the mines has remained about 21,000 tons annually, so that last year's figures exhibit a notable increase. In addition to this output, the copper content of 589,815 tons of pyrite exported, was 9958 tons, bringing the total for the year to 34,214 tons as compared with 32,317 in 1907. Less cupriferous pyrite is now exported and more is treated on the spot. The export of sulphur ore or barren pyrite has, however, continued to increase, being 668,477 tons in 1908, as compared with 619,814 in 1907, and 477,843 in 1906. A third item of importance is that large sums of money are being spent in improving the methods of mining. Extensive work is being conducted with the object of mining by open cast, and eventually the costs will be considerably reduced. At the present low price of copper it has been impossible to meet this expenditure out of incomes; accordingly the money has been provided by borrowing on the security of the reserve fund. The balance sheet states that the "Investment in Consols and other securities deposited against advances" is £623,350. The item of 'Creditors' has also increased by over £500,000 during the year. These figures show how immense are the financial resources of the company to permit of such extensive re-organizations during years of depression.



Dust Storm at Broken Hill.

The United Alkali Co. owns extensive pyrite mines in the south of Spain not far from Rio Tinto. Formerly the company bought pyrite from the Rio Tinto, the Tharsis, and other producers. Only within the last few years was the policy of owning mines adopted. The company reports that the mines now supply a large proportion of the pyrite required and that recent development has proved the existence of additional orebodies. Increase in cost of raw material, especially of fuel, together with the fall in the price of copper, and the bad general condition of trade, have reduced the profits of this great undertaking. Once more the ordinary shareholders have to go without a dividend. The net profit was £362,244, out of which £133,746 was distributed as debenture-interest and £187,878 went to the 7% preference shares.

Current history of the Broken Hill Proprietary is followed closely here. Cabled reports just to hand give results for the half year ending November 30 last, and show a none too brilliant condition. The output was 2,926,148 oz. of fine silver, and 47,842 tons of pig lead, for which the average prices obtained were 25.86d. per oz. and £12 per ton, respectively. The profit was £25,791, which, as the directors say, cannot be considered adequate to the capital. Not only has the margin of profit been reduced, but the cost of improvements, additions, and replacements has had to be provided by drawing on the reserve fund to the extent of nearly £80,000. In addition to all these worries the directors are troubled with lack of success in developing orebodies. They report that explorations on the lower levels have not added appreciably to the ore reserves. June 1, 1908, the ore reserves were estimated at approximately three million tons. During the half year 264,847 tons were extracted. If no further orebodies be found, the life of the mine at this rate will be little more than 5 years. As the shares, which have a nominal value of 8s., stand at 30s., it is evident that the troubles of the company are considered by many to be temporary.

The Palmarejo mine in the State of Chihuahua, Mexico, has been worked for over a hundred years, and in the early days the rich silver sulphides gave handsome profits by pan-amalgamation. When these ores were exhausted the deposits ceased to be of value. The mine was bought at a fabulous price by an English company 23 years ago. The history of this company during the first 15 years is not pleasing. Mr. Southcott finally undertook to re-organize and put it on a paying basis, with T. H. Oxnam as engineer. The pans were 'scrapped', and a cyanide plant substituted. However, the metallurgical difficulties still continued and losses were so great as to wipe out profits. Eventually the mill was closed and Edward T. McCarthy was commissioned to report on the property. Knowing that the ore was much the same as that treated with profit at Tonopah and in several parts of Mexico, Mr. McCarthy visited these districts before going to Palmarejo, to obtain the latest metallurgical information. On arriving at Palmarejo he found the ore to contain an average of 15 oz. silver and 1½ dwt. gold, and that it was amenable to the treatment recommended. He obtained extractions of 88% of the silver and 93½% of the gold, in an experimental plant rigged for the purpose. This should be compared with an extraction of 62% in the old cyanide plant. The costs in the modern plant would be less than in the old cyanide plant. Mr. McCarthy found one and a half million tons of readily available ore. His recommendation is that a 40-stamp mill be erected, with tube-mills, agitators, and filters, having a capacity of 260 to 300 tons per day. He also recommends improvements in power, water-supply, and transport, and he estimates that £116,000 will be required. The directors and shareholders are willingly subscribing this money.

Great interest has been centred on the Dolcoath mine during the last few weeks owing to the continued development of rich ore at depth. At the recent meeting of shareholders the matter was discussed at some length, and among others Richard Pearce contributed some valuable observations. Briefly, the increase in richness and the discoveries of new orebodies have taken place at about 3000 ft. in the portion of the mine where the new vertical shaft is to cut the lode and meet the workings at present served by the old inclined shaft. Mr. Pearce, who was connected

with this mine 60 years ago and has followed its fortunes ever since, is of the opinion that the new ore-shoots are only the apex of more extensive deposits. The company issued a special circular this week describing the exact position of the latest find, which runs a hundredweight of black tin per ton, as compared with the average of 40 lb. Naturally, when anything good turns up in the mine, it is somebody's business to exaggerate. In this case one of the London papers announced that rich copper-tin ores had been found in excavating for some new workmen's cottages, but this turned out to be a fable. The directors of Dolcoath feel that they were justified in sinking the new shaft, a policy which at the time of its inauguration had not a few captious critics. These, or similar gratuitous advisors, are now finding an outlet for their energy by joining the controversy as to whether the pumps which will be put in when the new shaft is completed shall be Cornish pumps or electric pumps.

SALT LAKE, UTAH.

Silver King Smelter. — International Smelter Plant. — Utah Con. Profits.—Boston Con. Output.—Bingham Mines.—Western Utah Copper.—Pioche Mines.

When it was announced a few days ago that F. Augustus Heinze was negotiating with the International Smelting Co. for the sale of the ore-contact which he had with the Silver King Coalition Mines Co., it was made known at once that officials of the mining company would not consent to such a transfer. Silver King officials claim that when Heinze secured this contract, it was with the distinct understanding that he would build and operate a smelter in Utah. Holders of large interests in the Silver King subscribed for stock and agreed to give financial backing to the proposed smelter which was to enter into direct competition with the A. S. & R and the U. S. Smelt., Min. & Ref. companies. Agents for Heinze claim that no such stipulation is in the contract and that they can dispose of it at will. The Silver King is shipping 100 tons of high-grade silver-lead ore to the American furnaces at Murray, having an average assay value of $60 to $65 per ton. The mine has been the largest silver-lead producer in Utah for a number of years. It has paid dividends in excess of $11,000,000 and is making quarterly distributions of 15c. per share, aggregating $187,500. The contract with Heinze calls for the delivery of ore to him for a period of 10 years beginning January 1, 1909. In compliance with this agreement the company began delivering ore to Heinze's agents about January 10. Heinze had, in the meantime, leased the Milford smelter and he had announced that the ore would be shipped to the furnaces in southern Utah, but as soon as the ore was received he consigned it to the A. S. & R. Co. The mine officials claim that they have given Heinze ample time to begin building his smelter; that they have been lenient in view of the fact that he was badly crippled in the financial depression. Unless he concludes to build the smelter, they announce their intention of forming an independent smelting company and embarking in the custom ore business. The contract now in force calls for a treatment-charge of $14 per ton, and metallurgists claim that this $8 ore can be treated at a profit. The contract would be worth several million dollars to Heinze, and the International company is supposed to have offered him more than $1,000,000 for the transfer.

The International Smelting & Refining Co. has let the contract for the excavation for the foundation of its smelting plant in Pine canyon. This work will require the removal of over 100,000 cu. ft. of earth. The contract for the steel structural work has already been let, and J. A. Dunlap is in Chicago to arrange for the equipment. The railway spur will be completed to the plant by May 1. It is said that the Salt Lake Copper Co., a Lewisohn concern, which has representation on the board, will ship its copper product to the International. This, in addition to the Utah Con., and with several silver-lead mines forwarding or to the International, will make it an active competitor for custom ores in Utah. The Utah Copper Co. has at the present time two shovels on ore in pit A; one on waste in each of the following contours, C, E, G, H, and two in F. A ninth shovel will be put to work directly on ore, and a tenth is now on the way.

The annual report of the Utah Consolidated Mining Co. shows that it has made a net profit during 1908 of $326,312. During this period it has produced 10,648,243 lb. copper, 265,284 oz. silver, and 23,440 gold. The property is producing 800 tons of copper ore daily, which is treated at the Garfield smelter. It is now paying quarterly dividends of 50c. per share, and has distributed profits amounting to $7,836,000.

The Boston Consolidated has increased its output. The mill is producing concentrate carrying 1,000,000 lb. of copper, to which the sulphide mine is adding ore carrying no less than 500,000 lb. per month. On this production it is claimed that the company is more than meeting its operating expenses. The subscription for the new stock amounting to 50,000 shares, will give the management about $550,000, less a 5% commission. Its indebtedness is now $450,000, and it will require $165,000 to pay the cost of removing the overburden to permit steam-shovel mining. The mill has a capacity of 3000 tons, and when the overburden is removed, which will require 4 months time, the company will probably decide to double its mill-capacity.

Experts for the Cole-Ryan syndicate have completed inspecting the Tintic smelter plant and the Colorado mine, belonging to the Knights. The financial condition of the Bingham Mines Co. is gradually improving. A payment of $97,000 has been made on its first-mortgage bonds, bearing 6% interest, reducing the total amount outstanding from $903,000 to $806,000. The mine is now producing 60 tons of silver-lead ore per day. Duncan McVichie has just returned from New York. While in the East he made arrangements for resuming operations at the Western Utah Copper Co. mine in the Clifton section of Deep creek. This company has more than 1,000,000 tons of ore carrying 5% copper. Herman Green is manager, and he will organize a force to begin work at once. The Western Pacific has promised to build a branch line into the camp, work to be inaugurated within a couple of months. There are other producing mines in that district. F. Augustus Heinze is one of the largest shareholders in Western Utah Copper. The Guggenheims have acquired some properties in that mineral belt. Four to five cars of ore per month are being shipped from the Prince Con. mine at Pioche. Murray and Ernest Godbe are now carefully sampling the new orebodies encountered in the lowest workings. James Breen, of Butte, a Heinze smelter man, has recently inspected the camp. He reports a large tonnage blocked out, sufficient to supply a smelter for a number of years. The Godbe syndicate, which controls the Prince, Ohio-Kentucky, and several other properties, are not disposed to make a contract for smelting until they have had an opportunity to test the Fink process further. Both the American and United States smelting plants are badly in need of lead ore. The two are running at about one-half their capacity, the American treating 1000 tons and the United States 700 tons per day. The Tintic Smelting Co. is taking about 1000 tons of lead ore daily which formerly went to these plants.

DENVER, COLORADO.

Degge Case —Craig Placer — Grand Junction. — The Jennie Sample Controversy.—Cripple Creek.—Lead and Zinc Ores.

About a year ago the Wellington Investment Co. obtained much undesirable notoriety through the methods of the promotor, W. W. Degge. The case has re-appeared in court, and a temporary injunction has been granted to the Mining Investor Publishing Co., restraining Degge from making use of the subscription lists of the Mining Investor. It was proved that Degge obtained these by questionable methods. The suit by the company for $10,000 damages was compromised by the payment of a nominal sum and costs. The Colorado Mines & Water Co., which purchased the Craig

placer from the Blivens Mining Co. early in 1908, has thoroughly tested the ground and worked out the problem of operation. The company has purchased new machinery of larger capacity than that taken over with the property. There are several thousand acres in this district that show gold in a fine gravel free from large boulders. Dredging will be started at once.

The Gibson Lumber Co. and the John F. Rice Lumber Co., both doing business at Grand Junction and Montrose, have been made defendants in a suit brought by the Federal Government to recover $60,000 worth of timber illegally cut near Montrose. The construction of the High Line canal, which starts near Grand Junction, is now assured. As soon as the local association has deposited its half of the money, the Reclamation Service will begin work on the tunnel through the Palisades. It is expected that condemnation proceedings will need to be resorted to in a few cases where right of way has been denied.

The fight for the control of the Jennie Sample Consolidated Mining Co., will doubtless end in the courts. At the annual stockholders' meeting, held in Cheyenne, two sets of officers were elected. The use of telegraphic proxies was questioned by the Bernard-Burns faction, and the matter was referred to the committee on credentials. It is the action of the credentials-committee in refusing to recognize the telegraphic proxies that will form the basis for legal action. During March the production from Cripple Creek amounted to $1,382,570. The average value of the ore was $22.95, which is an increase in value per ton of $2.50 over that for February. The deep drainage tunnel progressed approximately 1000 ft. during the month. The work is being pushed rapidly at all three headings. A vein carrying $3.60 in gold was cut 5400 ft. from the portal. This vein is believed to be the one showing on the Earl lode claim on Grouse mountain. The Birdsall lease on the Michigan Gold Mining Co.'s property on Gold hill has been sold to W. S. Rowell and associates. The Wacu Weta lode claim on Bull Cliff, adjoining the Cheyenne of the Isabella Mines Co., is advertised for sale at public auction.

A. B. Lewis has returned from Salt Lake City, where he witnessed a series of experiments made in the treatment of the lead-zinc ores from a mine he is interested in at Pioche, Nevada. The ore was concentrated on a Behrend dry concentrator. The experiment was considered satisfactory and arrangements will be made to erect a Behrend plant at the mine. The ore contains sulphides of lead, zinc, iron, carbonate of lead, and silicate of zinc.

BUTTE, MONTANA.

Pittsburg & Montana.—Production Costs. — Electric Power Development.—Coal Land Decisions.

Report concerning Pittsburg & Montana has it that the Amalgamated Copper Co. is the real interest behind the refinancing of that company, and that the East Butte, Pittsburg & Montana, and South Butte Mining Co. will be found shortly among the Amalgamated assets. The mines of the Pittsburg & Montana, under the management of Oscar Rohn, have been put in excellent condition and have been constantly improving. About 150 tons of first-class ore, and 200 tons of second-class, are mined daily, and even with the present smelter-capacity the production can be greatly increased. However, the smelter is being re-constructed and enlarged, and by the middle of July or the first of August the capacity will be 500 tons per day. The concentrator will be able to handle 250 tons, and will probably be later enlarged to 500 tons capacity. The company owns 287 acres of mineral ground in east Butte, with the extensions of a number of the big veins. In addition to this ground, it owns 600 or more acres near Helena and at Swissmont, including some iron claims and silver-lead properties. When the present management took hold, both the property and the company were in a bad way, following the long, expensive, and barren experiments of Ralph Baggaley with a new smelter-process. The new process has been discarded, and the Pittsmont ore shipped to the Washoe smelter at Anaconda. In the general curtailment of copper-production in the Butte district in 1907, the Washoe refused to receive any more Pittsmont ore. The mines were temporarily shut down and Mr. Rohn converted the old plant into an ordinary smelter, of 200-ton capacity. The mines were operated at a profit all through the panic and since. The converter-plant was entirely re-built and standard acid-lined converters erected. A 250-ton concentrating plant was also built during the summer of 1908. The blast-furnace capacity is now being increased by 300 tons. The first-class ore sent to the smelter runs 7% copper, and the second-class, going to the concentrator, assays between 3 and 4%. Most of the mining is done on two orebodies near the east and west ends of the property, about 2000 ft. apart. Between the orebodies the ground is practically unexplored. There are two working shafts, each 1200 ft. deep. From the 1200-ft. level two winzes have been sunk 300 ft., from the bottom of which 600 ft. of cross-cutting was driven several years ago. At present mining is confined chiefly to the 800 and 1000-ft. levels, though some ore comes from the 1200. On the latter level are about six miles of openings, cross-cuts, and drifts.



Butte Mines.

At the west end the 1000 and 800-ft. levels have been connected, and the ore is fully as good on the 1000 as on the 800-ft., the stope being 25 ft. wide. In a cross-cut south on the 800-ft. level, two new veins have been cut, assaying 7% copper; these are 6 ft. wide. On the west end of the 800-ft. level the showing has also improved.

A great electric power-system is being developed in Montana. In a few years not only the principal mining companies but the railroads will use electric power. The Chicago, Milwaukee & Puget Sound road has already contracted for power for the operation of its trains, and a few days ago officials of the Northern Pacific and representatives of the Madison River Power Co. discussed the operation of railway trains over the Montana division.

Sinking has been resumed by the Tuolumne Mining Co., the break to the machinery having been repaired. The North Butte Extension Development Co. has permitted its options on the Third Sphinx and Michigander to lapse. By the recent decision of Judge Hunt of the United States Court the Northern Pacific Railway company loses 1120 acres of valuable coal lands in Carbon county, which the company selected in 1899 in lieu of other lands. The coal lands were classified as non-mineral when the original Government survey was made, but Judge Hunt finds that the land was known to be coal land at the time it was selected by the Northern Pacific.

GOLDFIELD, NEVADA.

Goldfield Consolidated Mill Returns.—Little Florence.—Combination Fraction.—Daisy.—Fairview-Cherokee.

An important factor in the milling operations of the Goldfield Consolidated Mines Co. appears in the reduced cost of production since the starting of the new 600-ton plant on Columbia mountain. Prior to that time the Combination

mill had been treating ore with a total expense, for mining, milling, and transportation, of $8.15 to $8.50 per ton. In January the new mill handled the product with a total cost of $7.31 per ton, and in February and March the cost had been reduced to $6.31. Next to milling, the chief reduction was in transportation, which is now computed, on ore from all the mines, at 9½c. per ton, with the milling cost $2.61 and that of mining $3.61.

Electric power was first turned on in the new mill December 26, but with the inevitable delays and adjustments it was several weeks before the machinery was operating smoothly. During the greater part of January only low-grade ore from old dumps was fed to the crushers. It will be remembered that the refinery was not finished until later, and that none of the later stages of reduction could be attempted. Thus the month of January was by no means a criterion by which to gauge the normal output. The following official figures show the actual results of the company's milling operations during the three months following the completion of the new mill. The average recovery has increased in this period from 89 to 92%, and a reduction has been made in costs. In January the Consolidated mill treated 8564 tons, of the average value of $22.72 per ton, and the Combination mill 2772 tons, averaging $37.30; a total tonnage of 11,336 and total average $26.29. The total recovery for the month was $265,561.40. In February the Consolidated mill treated 12,967 tons, average value $40.78, and the Combination mill 2291 tons, average value $43.45; a total of 15,258 tons, averaging $41.18 per ton; total recovery, $565,781. In March the Consolidated mill treated 16,300 tons, averaging in value $50, and the Combination mill 2710 tons of the same average value, a total of 19,010 tons averaging $50 per ton, making a total recovery of $838,020. In addition to this, the company shipped 341 tons of high-grade ore from the Combination, the total recovery from which was $236,000, giving a total recovery for the month of $1,074,020, from which is deducted the sum of $116,788 for total expense, leaving a net profit from the month's operations of $957,232. The refinery is now employed to its full capacity upon precipitate and concentrate, and several hundred tons of concentrate which had been stored awaiting treatment in this plant by the Hutchinson process are being shipped to smelters. During the first three days of this week bullion to the value of $200,000 was shipped to the mints, and the same amount was sent out within a similar period last week.

At various levels and extending to a depth of 600 ft. the territory of the Consolidated company has now been developed almost continuously for a distance of 5000 ft. from the Red Top claim at the north to the rich veins of the old Reilly lease, south of the Combination workings. The ore-shoot in the latter, every description of which has called forth charges of exaggeration, is considered unique in point of quality and magnitude. In the centre high-grade streak a rich seam has been opened that yields 2 ft. of ore carrying from 300 to 400 oz. gold per ton. A raise has been completed from the 380 to the 280-ft. level. Several hundred company assay certificates at the main office vary from five to thirty ounces gold, while a few run above fifty, and offer convincing evidence of the importance of the recent discovery of a new ore deposit, opened at the 300-ft. level in the Red Top workings and in the Lucky Boy claim of the Jumbo group, in what was formerly thought to be barren ground. Near this point, from the Mohawk-Jumbo lease were taken quantities of high-grade ore, but the ore-shoot apparently gave out and the lease was abandoned. It proves that the workings missed this ore by only a few feet.

The Florence mine has another bonanza. A stope is being opened in the ore at the fourth level, 200 ft. deep, and from the cross-cut which has been run from the main shaft to the Little Florence lease workings. Across the 12-ft. face of the orebody, assays give an average return of nearly $260 per ton. Another vein of high-grade ore has been exposed at a depth of 500 ft. in the old Engineers' lease workings, near the company shaft, but has not yet been prospected sufficiently to determine its value.

GUADALAJARA, MEXICO.

New Power Plant.—Amparo Dividend.—Projected Smelters —Ameca District —Magistral Mines.

The transmission of electric power to mines and mills in the Etzatlán and Hostotipaquillo districts of Jalisco at a comparatively early date seems certain. Manuel Cuesta of Guadalajara, who owns valuable power concessions on the Santiago river, a concession for the use of the water of lake Chapala for irrigation purposes, and a concession for a competing light and power system in Guadalajara, has entered into a combination with the Pimentel interests of Mexico City, which control the light and power situation here, and as a result it is probable that current will be transmitted to the mining districts from one of the local company's power-plants. Mr. Cuesta has contracts for the delivery of power to the Amparo Mining Co. in the Etzatlán district, and to the Casados and El Favor companies in the Hostotipaquillo district. He has planned to transmit the power from a new plant on the Santiago river. The combination makes it unnecessary to install a new plant in order to fill the contracts, and the mining companies will benefit to the extent of securing power earlier than would otherwise have been possible. The Cuesta contract with the Amparo company, which was signed last year, calls for the delivery of power by July 1. It will be impossible to comply with this provision, and a penalty of ₱100 per day, or ₱3000 per month, will have to be paid. The contracts with El Favor and Casados were made recently. The former calls for delivery by October 1, next, and the latter by the opening of the coming year. There is a penalty clause, similar to that with the Amparo, in each contract. Power will be supplied to each of the three concerns at the rate of ₱100 per horsepower year. The Amparo will take 700 hp.; El Favor, a minimum of 250, and Casados, a minimum of 150.

The second quarterly dividend of the Amparo Mining Co., of Philadelphia, will be paid on May 10. It will be 2½%, amounting to over $60,000. The Amparo reached a dividend basis in February last, when the first quarterly was paid. The money for the May dividend is now in bank in Philadelphia, and does not include any part of the revenue from the mines and mill for the month of March. At the annual meeting of the company, held in Philadelphia recently, all the officers and directors were re-elected. A letter congratulating James H. Howard, general manager, and his brother, William Howard, who is in charge of the Amparo reduction plant, for the excellent showing made during the last year, was authorized at the meeting. A reverberatory smelter, instead of a concentrating plant, will be erected by the Magistral-Ameca Copper Co. at the Magistral copper mines in the Ameca district of Jalisco. It will have a daily capacity of 150 tons. The decision to erect a smelter instead of a concentrator resulted from the continued development of high-grade copper ore. The order for the smelter was placed in Denver, and it is hoped to have it in operation within six months. W. E. Eells, general representative of the Towne smelter at San Luis Potosí, has made a deal for the Monterey & Union copper mines in the Ameca district. The mines are owned by Neil Trumbull of Guadalajara and H. K. Taylor of Etzatlán. They will receive ₱50,000, and a third interest in a company to be formed to work the properties. The ore is rich, some of it running 35% copper. The Towne interests are behind the deal. A smelter with a capacity of 100 tons daily will be erected this year by the Philadelphia Copper & Gold Mining Co. at its San Vicente mines in the Ameca district. It is said that the ore available amounts to 75,000 tons. Development has been in progress several years. Chester P. Ray is president and M. J. Slattery general manager. Bonanza ore was recently found in one of the new workings of the Cinco Minas in the Hostotipaquillo district. According to reports, some of the ore assayed 19,000 grams silver per carga (300 lb.), or about 127 kg. per ton. The Cinco Minas are under option to H. E. Crawford, representative of the Marcus Daly estate, for ₱530,000. J. W. A. Off of Los Angeles has succeeded M. N. Graves as manager of the Magistral mines in the Etzatlán district.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Petroleum in Illinois runs 30 to 32 B. and brings 60 to 68 cents per barrel.

Products of the mines furnish 64% of the total railway freight tonnage.

Fluorspar is used in making open-hearth steel, from ? to 9 pounds being needed per ton.

In the big disseminated copper deposits there is a tendency for the metal to be segregated at the acid end of the intrusion.

Ore run was defined by Jenney as an irregular ore-body found at the intersection of an ore-horizon with a vertical fissure.

Molybdenum is used in steel-making, having the same effect as tungsten. Only half to one third as much is needed per ton of steel.

The heat-value of coke that goes into a furnace is only about one-fourth of that available for heating the hearth; about one-half is sensible heat in the gas, and about one-quarter reduces the ore.

The Rate Commission of Wisconsin has discarded the candle-power standard for illuminating gas, and substituted one based on calorific power, the one adopted being 600 British thermal units.

Cassiterite, the dioxide of tin (78.6% Sn), is the principal source of that metal. Stannite, a complex sulphide of copper, tin, iron, and zinc, is worked in a few places as an ore, but never for its tin alone.

Glass rock is a term applied in the Wisconsin zinc district to a fine-grained non-magnesian limestone breaking with a conchoidal fracture and found near the top of the Trenton formation. The ore is found mainly in or above it.

Ochre may be tested as to its value by determining the amount of oil which it will absorb. This seems to depend on both its chemical composition and on the fineness and regularity of its grains. It is gauged by comparison with the absorptive power of prepared pigments.

Pegmatite is a term first applied to the intimate interpenetration of quartz and orthoclase crystals now more often designated graphic granite. It is at present generally employed for igneous rocks of unusually coarse texture with a prefix such as 'granite-pegmatite' to indicate the composition.

Kimberlite, the rock in which the South African diamonds occur, is found in Arkansas and eastern Kentucky. Nearly identical rocks occur in western Kentucky, southern Illinois, at Syracuse, New York, and in the Highlands of the Hudson. Diamonds have only been found in the Arkansas occurrence.

Burning temperatures for clay goods are usually measured by the melting of cones, which are standardized and numbered. Common brick, tile, and fire-proofing are burned at cone 0.010, corresponding to 1742°F.; front brick, terra cotta, sewer pipe, stoneware, at cone 7, 2318°F.; fire-brick at cone 15, 2606 F.; while the lowest fusing point for good fire-clay is at cone 26, 3002° Fahrenheit.

The deepest bore-hole in the world is now said to be one drilled near Rybnik, in Upper Silesia. It has attained a depth of 7070 ft., and the intention is to deepen it, if possible, an additional 300 or 400 ft. The hole was started in December 1906 with a diameter of 16 in. At a diameter of 7 in. the diamond-drill was substituted for the churn-drill. At the depth of 7070 ft. the diameter had become reduced to 2 inches.

Molybdenite, free from copper, commands from $4 to $5 per unit (20 lb.) when the ore contains above 80% molybdenum sulphide (MoS_2). The average grade marketed contains about 90% of the sulphide. Large deposits of molybdenite are rare. In the desert region of the Southwest it is a mineral frequently found at or near the outcrop of copper veins. A discovery of molybdenite in that region would warrant further search in depth for copper.

Antimony ore containing 22% antimony, 13 lead, and 3 zinc would find no market. Even ores much richer in antimony and lead have recently failed to find takers. If labor conditions and fuel are sufficiently cheap it might be possible to concentrate such an ore to a high-grade regulus into which the zinc would not follow. Such an operation would be attended with considerable loss of metal, but a marketable product might be made in that manner.

Sizing, in the parlance of the millman, means, or should mean, the separation of broken or crushed ore by screening. The separation of ore into classes by hydraulic means is classification. The distinction is important, and millmen will do well not to use the terms carelessly. Theoretically a classified product consists of particles which will fall with equal velocity in water. Practically, such close classification is impossible. The desirability of classification as against sizing is still a moot question, with the argument probably in favor of classification from the standpoint of combined efficiency and economy.

Magnesite is a carbonate of magnesia containing 52.4% of carbon dioxide and 47.6 magnesia. It is used mainly for making carbon dioxide, now usually marketed as a liquid. The residual magnesia is converted into 'sulphite' ($MgSO_3$) and used for whitening paper. Magnesite is also used in making refractory brick, shapes, and crucibles. Small amounts are made into epsom salts for medicines and alba levis for toilet uses, as an absorbent for dynamite, and as boiler lagging. Limited amounts are used in making oxychloride cement, as an adulterant in paint, to prevent scale in boilers, and for various chemical and electro-metallurgical purposes.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Cyanidation of Silver Ores.

The Editor:

Sir—I have read with interest the articles on the cyanidation of silver which have appeared recently in the MINING AND SCIENTIFIC PRESS. It is apparent from these that the chemistry of the process still presents many unsolved problems. In connection with the Wall Research Fellowship at the Utah State School of Mines, I am conducting a series of experiments on silver ores and minerals. A few of the more important results are tabulated below.

TABLE I.

No.	Method of Treatment.	Ag Dissolved, mg.	KCy Consumed, mg.	Ag Dissolved, %.
1	0.5% KCy solution	14.02	...	7
2	0.5% KCy solution	14.42	...	7
3	Solution charged with O_2	40.50	75	19
4	Added 383 mg. $PbAc_2$ (lead acetate)	190.92	271	88
5	Added 450 mg. $PbAc_2$	170.20	256	79
6	Added 1000 mg. $PbAc_2$	130.30	282	60
7	Added 227 mg. PbO	214.20	318	99
8	Added 500 mg. PbO	211.10	318	97
9	227 mg. PbO + 200 mg. Sb_2S_3	41.85	...	19
10	500 mg. CaO + 200 mg. Sb_2S_3	4.06	...	2
11	475 mg. Hg_2Cl_2	198.00	312	92
12	1800 mg. Hg_2Cl_2	126.30	600	58
13	1800 mg. Hg_2Cl_2 + 300 mg. K_4FeCy_6	113.90	622	53
14	150 mg. $SbCl_3$	140.80	527	68
15	150 mg. $SbCl_3$ + 200 mg. Sb_2S_3	90.90	615	42
16	500 mg. NaCl	33.80	...	16
17	243 mg. $PbAc_2$	185.20	293	85
18	227 mg. $PbAc_2$ + 227 mg. PbO	185.80	300	86
19	No Oxygen present	11.10	...	5
20	" " + 383 mg. $PbAc_2$	73.94	144	33
21	" " + 383 mg. $PbAc_2$	74.40	165	34
22	" " + 383 mg. $PbAc_2$ + 227 mg. $PbAc_2$	100.70	...	49
23	" " + 227 mg. PbO	18.88	...	9
24	" " + 227 mg. PbO	17.20	...	8
25	" " + 227 mg. PbO + 227 mg. $PbAc_2$	127.60	184	59

In working with ores from various mines it was found that the many unknown factors made generalizations dangerous. Even a chemical analysis leaves important facts unknown, such as the form in which the elements are combined. Therefore many of the experiments were conducted on artificial ores in which active agents have been introduced one at a time. Not only is it true that the same factors affect the solubility of gold and silver differently, as pointed out by Mr. Caldecott (MINING AND SCIENTIFIC PRESS, Aug. 29 and Dec. 12, '08), but the character and extent of this difference is due to the mineral form in which the silver occurs. In the case of metallic silver, experiments indicate that the effects are the same as those on gold, the only difference being in degree. For example, the introduction of lime decreases the solubility of both native silver and gold in a cyanide solution. Also it is well known that oxygen, or an oxidizing agent, is essential for solution in both cases. With some of the silver compounds on the other hand, the introduction of lime or of an alkali is an important aid to extraction, and in the case of AgCl oxygen plays no part in the reaction. Percolation, soaking, and air-agitation tests have all been tried, but for the purpose of securing comparative results the ordinary bottle test is most effective.

The experiments given below, except those from which the air was excluded, were made in 8-oz. salt-mouth bottles. Ten of these were clamped in a frame, and rotated by a small water-motor. The speed was so regulated that the contents of the bottle would fall from one end to the other during each half revolution. As the bottles were only partly filled, the agitation and aeration were probably both as favorable as will obtain in practice. Most of the tests were run over night and the temperature varied from 10 to 20° C. In Table I are given results obtained on silver sulphide precipitated from a silver nitrate solution; 250 mg. of Ag_2S, equivalent to 217.7 mg. of silver, was agitated 17 hr. with 150 c.c. of a 0.5% solution of KCy. The extractions are based on solution-assays.

Duplicate tests, three of which are included in the above list, show that the variations in speed of rotation and temperature did not seriously affect the results. The air-tight tests, 13-25, were made in 160 c.c. Erlenmeyer flasks. After adding the Ag_2S and other chemicals, with the exception of KCy, the flask was filled with distilled water and the contents boiled under reduced pressure for about 15 min; 800 mg. of pure KCy was then dropped in, the flask tightly sealed, and quickly cooled to the temperature of the room.

The amount of lead and mercury available in the compounds added to tests 4, 7, 9, 11, 17, 20, 21, 23, and 24, is the computed weight necessary to combine

with the sulphur resulting from the complete decomposition of the 250 mg. of silver sulphide. The reason for the method of treatment in each case, and the most probable explanation of the effect produced, would involve a discussion of ionic equilibrium and other fundamental laws of chemistry, obviously beyond the scope of the present article. But readers who have followed closely the previous discussions of the subject (MINING AND SCIENTIFIC PRESS, May 2, Aug. 1, 8, and 29, Sept. 26, and Dec. 12, '08) will, I think, readily understand the 'wherefore' in the above experiments. It is clear that oxygen plays an essential part in dissolving silver sulphide in cyanide solutions. It is more important when litharge is the precipitant of soluble sulphides, than when lead acetate is used. It is also interesting to note that in

TABLE II.

No.	Method of Treatment.	—Assay— Heads, Oz.	Solution, Oz.	Extraction, %	Ag. Mineral.
1	0.5% KCy solution	48.40	23.20	48	Ag_2S
2	" + 100 mg. PbO	48.40	42.80	89	"
3	" + 100 mg. PbO + 100 mg. Sb_2S_3	48.40	14.22	29	"
4	" + 170 mg. $PbAc_2$	48.40	36.84	76	"
5	" + 1.02 gm. Hg_2Cl_2 + 200 mg. K_4FeCy_6	....	29.68	61	"
6	" + 510 mg. Hg_2Cl_2	48.40	30.52	63	"
7	0.5% KCy solution	47.70	8.57	18	Ag_3SbS_3
8	" + 100 mg. PbO	47.70	2.44	5	"
9	" + 170 mg. $PbAc_2$	47.70	0.97	2	"
10	" + 1.02 gm. Hg_2Cl_2 + 200 mg. K_4FeCy_6	47.70	5.68	12	"
11	" + 1.02 gm. Hg_2Cl_2	47.70	5.86	12	"
12	" + 510 mg. Hg_2Cl_2	47.70	6.40	13	"
13	0.5% KCy solution	48.50	6.28	13	Tetrahedrite.
14	" + 100 mg. PbO	48.50	1.07	2	"
15	" + 170 mg. $PbAc_2$	48.50	0.59	1	"
16	" + 1.02 gm. Hg_2Cl_2 + 200 mg. K_4FeCy_6	48.50	1.85	4	"
17	0.5% KCy solution	55.51	17.45	31	Ag_3AsS_3
18	" + 100 mg. PbO	55.51	3.24	6	"
19	" + 170 mg. $PbAc_2$	55.51	2.74	5	"
20	" + 1.02 gm. Hg_2Cl_2 + 200 mg. K_4FeCy_6	55.51	9.92	18	"
21	1.75% KCy solution; no lime	73.02	50.46	69	Ag_2S
22	" + 1 gm. KOH	73.02	61.85	85	"
23	0.1 % KCy, 15 hr. agitation	74.27	4.36	6	Ag_3SbS_3
24	10.0 % " " "	74.27	54.00	73	"
25	0.1 % " " "	51.38	2.64	5	Tetrahedrite
26	3.0 % " " "	51.38	12.60	25	"
27	0.05% " " "	43.92	41.00	93	Embolite
28	0.05% " " "	44.40	7.74	17	Ag_2S
29	0.1 % " " "	57.35	54.20	95	Ag (Native)

cases where there is no excessive consumption of cyanide, the ratio of the silver dissolved to the cyanide consumed closely approximates 216 : 325. This is the proportion demanded by the most generally accepted equations.

The largest number of my experiments are being carried out on silver minerals of a high grade of purity. These were secured from the Foote Mineral Co. and from the Museum of the University of Utah. One example will serve to illustrate the method of preparing the so-called 'ore samples' from these silver minerals. 1.6 gm. of a crystallized specimen of pyrargyrite (Ag_3SbS_3) was crushed with a few grams of quartz sand in a porcelain mortar, to pass a 100-mesh screen. This was then mixed with 550 gm. of quartz sand which had been ground on a stone bucking-board to avoid the introduction of iron. After adding 1.6 gm. of lime the sample was thoroughly mixed and quartered. Duplicate assays on this prepared ore gave 47.70 oz. silver per ton. 50 gm. of ore was introduced along with 100 c.c. of solution into 8-oz. bottles and agitated as in the previous tests. Agitation by compressed air on larger samples gave similar results. Extractions are figured on solution-assays in all cases except where these are shown to be in error by similar tests and by tailing assays. In cases of almost complete extraction better results can be obtained by assaying the tailing. Except where otherwise stated, lime is present to the extent of 6 lb. per ton of ore, and the samples were agitated 17 hr. in a 0.5% KCy solution.

The above experiments, along with others not tabulated, prove rather conclusively that the usefulness of lead salts is limited to those ores containing silver as argentite, or in which there is danger of the silver being re-precipitated as Ag_2S. In case the silver is present as proustite, pyrargyrite, or tetrahedrite, the addition of lead salts in the presence of lime would seem to retard rather than assist solution. This fact will probably help explain the poor effect of lead compounds applied to a certain Mexican ore, as instanced by Mr. Caldecott (M. & S. P., Aug. 29, '08). The chemical reactions involved are obscure. The addition of stibnite, in the presence of PbO, in (3) is fatal. Also tests 9, 10, and 16, Table I, show its evil results. In case of the difficultly soluble silver minerals, I have not experienced the beneficial results of adding Hg_2Cl_2 (see tests 5, 6, 10, 11, 16, and 20), found by Mr. Hobson (M. & S. P., Aug. 8, '08) to hold true for some Mexican silver ores. Possibly some essential factor is lacking in my tests.

The use of litharge seems preferable to lead ace-

tate when dealing with soluble sulphides, for reasons mentioned by Mr. Eye. Also it may be added in excess without seriously affecting results. I should like to know if its limited use in practice is due to controlling patents. I have attempted little more than the tabulation of a few experiments in the present article. I shall later present fuller data in graphic form.

THEO. P. HOLT.

Salt Lake City, February 26.

Rock Determinations.

The Editor:

Sir—I sent you six specimens of rock the other day by mail for determination. As a matter of curiosity, I had five graduates of the foremost mining schools in America make a determination independently. The results are so curiously different that I append the results, with a column for the results you may find in San Francisco:

No.	1	2	3	4	5	6
1	Trachyte	Volcanic Ash	Rhyolitic Trachyte	Trachyte	Tuff	Quartz Porphyry
82	Basalt	Quartz Felsite	Diabase	Basalt	Andesite	Basalt or Basic Andesite
86	Basalt	Andesite	Basalt	Felsite	Andesite	Andesitic or Basaltic Trap
103	Felsite	Felsite Breccia	Trachyte	Felsitic Rhyolite	Trachyte	Pyritized Rhyolite
102	Trachyte	Trachyte Breccia	Trachyte	Trachyte Porphyry	Rhyolite	Pyritized Rhyolite Porphyry
85	Diabase	Diorite	Diabase	Felsitic Diorite	Felsite	Metamorphosed Andesite

These cannot all be right, and it might be worth the candle to make a note in 'Concentrates' to point out how the errors in determination have arisen. Most (in fact, almost all) are recent graduates of Columbia and Houghton.

A. T. TYE.

Arizpe, Mexico, February 9.

[The foregoing implies an inaccuracy in petrographic determinations which the internal evidence of the communication itself fails to justify. In view of the fact that 'No. 6' in the table happens to be the petrographer of the MINING AND SCIENTIFIC PRESS, we are able to state that no slide was prepared for microscopic examination, nor was a chemical analysis made; for 25 cents the labor that would cost anywhere from $10 to $15 could not be performed. The rock determinations by this journal are better than those which a well-trained geologist can make in field or camp, because superior laboratory conveniences are available; yet they are only close approximations to accuracy. It might easily be possible, for example, to call a trachyte a 'rhyolite' when a typical variety was not presented. Many rocks pass from one to the other by insensible gradations; near the border-line it is immaterial whether it be classed on one or the other side, unless important issues are at stake. Inspection of Mr. Tye's table shows a most striking agreement among the several analysts, excluding 'No. 2', who was lacking in proficiency throughout. For work of the order which a field-geologist would do, which is manifestly the kind performed, the result is a vindication of the excellence of the training given in the schools. If the determinations were to be made microscopically we would expect this group of men to be in complete accord.—EDITOR.]

What Is an Ore?

The Editor:

Sir—I have read with interest the article on 'What Is an Ore?' by James F. Kemp, and consider that his definition is still too indefinite for general application, particularly as regards the needs of the miner and the layman. No complete gradation of quality is available, such as 'high-grade', 'low-grade', or 'too low-grade to pay under present circumstances'. I would, therefore, offer the following as my interpretation of the English word, and believe that it will cover all classes of mineral compounds known in common parlance as 'ore', namely, the constituent in a rock matrix, either metallic or metalliferous, of sufficient commercial value to warrant the exploitation of the deposit and the reduction of the output to a marketable commodity; 'high-grade' ore, which returns a large profit; 'low-grade' ore, which, (1) returns a small profit, (2) only pays the expenses of operation, (3) can only be mined at a loss, but may be of value at some future time.

W. J. ADAMS.

San Francisco, March 25.

Oil Measures in the Coalinga District.

The Editor:

Sir—A few remarks from one familiar with the conditions may be of interest to your readers in connection with the able article by William Forstner in your issue of March 13, 1909, entitled 'Oil Measures in the Coalinga District'. Considerable criticism of the work of the geologists Ralph Arnold and Robert Anderson is being indulged in by persons locally interested in the Coalinga and Kreyenhagen oil-fields, and an attempt will be made to give, in a disinterested manner, the causes leading to the controversy. Certain lands, described in Bulletin No. 357, U. S. Geological Survey, were withdrawn from entry except as mineral land, the recommendation for such withdrawal presumably being made by the geologists. The writer has no information as to this, but it seems probable that instructions to the geologists would call for segregation of such lands as were deemed of value for their mineral contents, other considerations being neglected. Prospecting work was being carried on outside of the area withdrawn, as at the properties named by Mr. Forstner, and the segregation of the land acted in two ways to the detriment of such companies. First, the stock was depressed by the classification, which was doubtless detrimental to some if not to all of the companies. Second, title to

the properties could be clouded by those who chose to lay homestead claim to the lands. Protest was common, and other lands were later included with those already withdrawn from entry. As to the local conditions, it should be stated that in the district under discussion homesteading is a method commonly used by locators to obtain title to lands which are practically worthless except for the possibility of their bearing oil. Homestead 'shacks' are erected, and a few furrows ploughed under the guise of preparing a piece of land for cultivation. Many such locations are in places where irrigation would be impossible, and furthermore are near lands where attempts have been made to farm, and numerous monuments of the failure are seen in the form of deserted houses and barns and fragments of fences. Doubtless the second segregation of land is just, as it serves to prevent such abuse, and allow the miner (for the oil man is a miner, although the idea may not occur to the casual observer) to proceed with his prospecting without fear of the 'jumper'.

Another local condition quite worthy of mention is the fact that a large portion of the small oil-operators know absolutely nothing of elementary geologic principles, and their criticism of geologic work is worthless. Many thousands of dollars are expended on lands where a glance is enough to show the geologist that the possibilities are a minus quantity. With considerable knowledge of geologic conditions in the Coalinga district, the writer believes that the report by Arnold and Anderson will stand the test of development, and that local operators will profit more by studying the bulletin and governing their prospect work by its suggestions than by criticising.

R. P. McLaughlin.

Panoche, California, April 3.

Churn-Drill Sampling.

The Editor:

Sir—I have read with great interest W. E. Thorne's article in your issue of March 6. I quite agree with him in saying that no property should be considered as proved when prospected by drills alone. There are so many points of information required to give complete knowledge of the ground, impossible to obtain by means of a drill alone, that it is surprising what confidence is put in results obtained in this way. In the examination of a placer property, the object is to determine the amount of gold in the ground that can be saved by practical methods. To do this in the best manner, the natural way would be that which most nearly followed the approved and tried methods employed in actual working. But in the majority of cases we are compelled to find other means. This necessity led to the method of prospecting by drills in California, and it has proved of such good use as to have replaced all others. In general, it can be said that returns have justified the method; in consequence, operators complacently take the results, as they have just as complacently taken other things that have become established.

The examination of a property by prospecting with drills alone lacks information on one of the very essentials of successful operation, namely, the gold-saving. Gold taken from the bottom of a drill-hole cannot be consistently tested for amalgamation, for the character of it is liable to be changed by the grinding. In the mind of the layman, it is generally considered that, to make a placer property successful, it is only necessary to have the gold in the ground. Failures arise from other troubles.

When placers were worked by inexpensive methods, as in the old days, longer chances were taken on reports of a property, from the fact of the smaller investment and the many rich properties available. In many cases the loss of half the gold would not be a cause for worry, as the remainder was enough to make the investment profitable. At the present day, however, the minimum loss is regretted, both because the properties are much lower in gold content and because economic conditions receive more consideration. The investment necessary is greater and the preliminary investigation should be correspondingly closer.

In a locality like Oroville all the conditions are practically determined before a dredge is even considered, and the drilling of the property is only necessary to determine the gold content. In a new locality additional means must be employed to determine the other essential conditions, and this should follow what we know to be best in current methods of operation. It is just as essential to know how the gold must be saved, and to make satisfactory experiments to this end, as it is to know how much gold there is in the ground. Of what use would ground be to an operator which would prospect 50c. per cubic yard, if he could only save 10c. out of it?

This brings us down to the one way out of the difficulty, which is to sink shafts, as suggested by Mr. Thorne, and to handle the dirt from them in the manner most nearly approaching actual working conditions. True, this may not always be possible, on account of water, but in many cases a small pump will take care of that. Objection is frequently made to the expense of all this, but from the standpoint of good business this is so small, compared to the proposed investment, as to be comparable to insurance.

As to the need of these precautions, I can say that I know of at least one case where a large sum of money was expended in purchase of equipment and property, yet up to the time operations were started, the management did not know whether the gold would amalgamate or not. I have under observation another property, which pays about the same proportion of 50 to 10 mentioned above, comparing results from prospecting and the returns from the sluice-boxes. In this, as in every other phase of the mining game, we can truly say that 'history repeats itself', but that it does, is largely due to ignorance and poor business methods.

Carney Hartley.

Denver, March 17.

Steam-plant coal consumption per horse-power-hour ranges from 1½ lb. in large highly refined steam plants to perhaps 5 lb. in smaller and simpler ones; the corresponding values for gas plants will range from a little over 1 to a little over 2 pounds.

ECONOMIC CONDITIONS IN COLOMBIA.

Written for the MINING AND SCIENTIFIC PRESS
By F. LYNWOOD GARRISON.

Since the issues of the MINING AND SCIENTIFIC PRESS of January 2 and February 6, 1909, containing articles by myself concerning Colombia, I have received many letters asking about the climate, mining laws, land titles, labor conditions, etc. As it is inexpedient to answer such communications individually, I have prepared the following sketch, covering the subjects, as far as my limited knowledge will admit.

It seems to be the universal verdict of travelers and explorers in South America that the moist tropical sections of the interior, wherever the elevations are less than 1000 ft. above the sea, are malarial, and that these fevers are more malignant in some places than in others. On the coast, on islands swept by the trade winds, or where conditions of semi-aridity exist, as in certain parts of the island of Santo Domingo, malaria is infrequent or non-existent. In the valley of the Magdalena river and its tributaries, wherever the elevation is less than 1000 ft., malaria is common, and appears to be nearly as dangerous to the natives of the mountain districts as to foreigners. The lower Cauca valley, in the Cáceres district, is no exception to this rule; the little town of Cáceres, about 600 ft. above tide, is situated on a high gravel bank rising above the Cauca river 30 or 40 ft.; the main street is completely and the side streets are partly paved with cobblestones, and have such steep grades that no stagnant water can collect. As a consequence I was not in the least troubled with mosquitoes in the old warehouse overlooking the river that my party occupied in this town. At every other place in that region, except on high elevations in the mountains, mosquitoes are common, and of the *anopheles* or malarial type. Above the town of Cáceres the Cauca valley is shut in by mountains and the current of the river becomes much swifter. This does not appear, however, to prevent mosquitoes from breeding, as they are to be found everywhere in the jungles, though infrequent on cleared spots high up on the banks above the stream. It is evident, therefore, that if one desires to avoid risking health and life when making a prolonged stay in the lower Cauca valley, it is absolutely necessary to occupy a well ventilated, thoroughly screened house on a high completely drained bank above the river, and to be provided with an abundance of plain, well prepared, and wholesome food. If these precautions are observed and pains be taken to avoid mosquito bites when working in the jungle, which is a difficult thing to do in a hot country, good health should be assured at all seasons of the year. All the low valleys of Colombia appear to be regarded with dread by the natives of the healthy mountain districts. Possibly some of this evil reputation is undeserved, although it would seem that there are places in these districts deadly to white men, as well as to Indians.

Cases of beri-beri have been known among foreigners in Colombia, and it seems that this disease, as well as leprosy, are not uncommon with natives. I myself saw a number of cases of elephantiasis, some of goitre, and a few which I took to be leprosy. Although loathsome, no disease carries the terror of beri-beri, and I see no reason why they should be specially feared when cleanliness is observed and care is taken in selecting the persons to whom clothing is given for washing. They used to tell me in China, whenever the wash was slow in getting in, that the washerman and his family were probably wearing my clothes, a discomforting thought to anyone who knows how dirty a Chinaman can be!

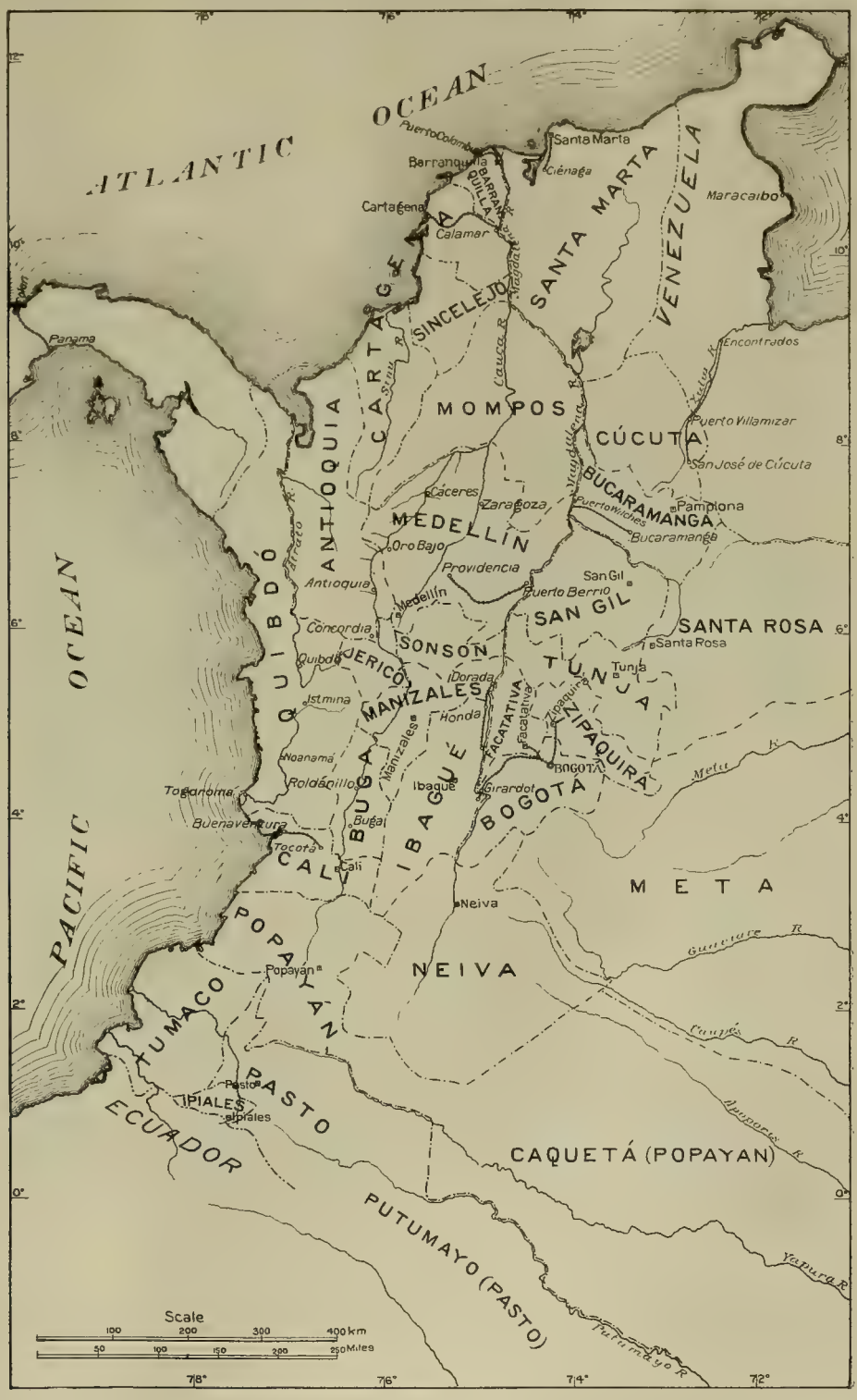
Before leaving this subject, it might be of interest to observe that there is much ignorance among educated people regarding the group of diseases commonly called malaria. I have often heard good physicians at home dismiss the subject with the remark, "Oh, chills and fever. That's nothing. Easily cured with quinine." So I thought also before acquiring in my blood a choice assortment of *plasmodium malariae* from the Cauca and Magdalena valleys. The *plasmodium malariae* was described by Laveran some thirty years ago, and that this germ is transmitted from one person to another by a certain type of mosquito, of the genus *anopheles*, has been proved beyond question in the last ten years. The physicians on the Panama Canal Zone classify malarial fevers under the following seven heads, and during the year 1898 treated in the hospitals the number of cases indicated by the figures:*

	Discharged.	Died.
Malarial fever	816	42
Aestivo-autumnal malaria	3837	13
Tertian malaria	2260	1
Mixed malaria	185	..
Clinical malaria	4849	27
Malaria cachexia	200	3
Hæmoglobinuric fever	29	11

These fevers may be classed thus: (1) quotidian malaria, in which the fever attacks every day, and is difficult to cure; (2) tertian malaria, in which the fever comes every other day (72 hours), the specific germ of which is known as *plasmodium vivax*; (3) quartian malaria, in which the fever returns every fourth day, the germ of which is known as the *plasmodium malariae*; (4) aestivo-autumnal malaria, the usual tropical variety; (5) pernicious malaria, the deadly blackwater fever, known scientifically as *laverania malariae*; (6) some people differentiate further and distinguish a bilious malaria, which is accompanied by sickness and torpidity of the liver, and intense headache, a type that is often fatal. Probably these symptoms may be common to any or all the above varieties, depending upon the constitutional idiosyncrasy of the individual affected. These classifications are obviously faulty and unsatisfactory, for all the peculiarities of this disease are by no means known or understood. All malarial germs are protozoans, that is to say, they are not bacteria. The life history of a malarial parasite in the human system may be summarized as follows: In the human blood these protozoa inhabit the red blood corpuscles and go through a sporulating existence which may continue indefinitely unless checked by quinine or in some other way. In the red corpuscles the parasite

*Report of the Isthmian Canal Commission for the year ending 1908, p. 290.

appears as an amoebula which gradually grows until it nearly fills the interior of the corpuscle, digesting apparently the red coloring matter of the blood and forming as a result pigment spots in its interior.



New Map of Colombia.

On reaching full growth the nucleus of the amoebula subdivides, each division gathering about itself a certain amount of protoplasm until, instead of a single amoebula, the corpuscle contains a large number of spores. The walls of the corpuscles then break and the spores are liberated into the blood serum. From a single infection this sporulation or liberation of spores or toxins takes place practically simultaneously and marks the beginning of the malarial spasm or chill. Quinine is the only cure for malarial fevers, and when taken in a liquid form it acts more quickly than in the condition of an or-

dinary hard pill. In the French Army in Africa, malaria is treated with sub-cutaneous injections of quinine of from one-half to two grams daily. The quinine doses are most effective when administered in any manner just as the chill or spasm is about to begin. In severe cases doses should not be less than ten grains, and medical assistance must be sought as promptly as possible, especially in the tropics.

I have heard of some cases of the deadly 'blackwater fever' in Jamaica, but none in Panama or Colombia, although, like the beri-beri, if once introduced it may be difficult to stamp out under favorable conditions for its propogation. The blackwater fever is common in Africa, just as beri-beri is in China and Japan. On the whole, it is probable that the climate of the low valleys in Colombia is much the same as that on the Isthmus of Panama, and will be quite as dangerous to health unless precautions be taken. The efficacy of such care on a large scale is now to be seen in the Canal Zone, and there would seem to be no reason why similar precautions cannot be exercised on even the smallest engineering operation in Colombia. It will naturally be asked, why are any operations attempted in these unhealthy sections; why not go to the higher and healthier places? The answer is that it is chiefly in this low-lying country that we find the alluvial gold-bearing deposits which have in the past and will even more in the future, make Colombia famous.

The mining laws of Colombia appear to be liberal, and the government is fully alive to the advantages of attracting foreign capital and enterprise. President Reyes has taken a sensible and decided stand against granting concessions to speculators and investors without strong financial backing, who he fears would simply peddle these grants and end in tying up valuable properties for a term of years, to the detriment and hindrance of the legitimate development of the country.

Land titles in Colombia, especially when coming from individuals, usually appear to be open to suspicion; in fact I have been told that the State Department at Washington has had difficulty in protecting American rights in this particular. Both private persons as well as our own Government officials, who have had experience in Colombian matters, unhesitatingly counsel caution. Such difficulties are apparently chronic in countries that have suffered from repeated governmental revolutions, and they are perhaps the greatest drawback to development.

The Colombian Government exacts an export duty or royalty tax of 1% on all gold exported from the country. When the gold exported comes from a concession granted by the Government, 5% is charged on the value of the gross production, but an additional export tax is not exacted. Emerald mining is a government monopoly, and individuals are prohibited from undertaking it. Coal, and I think also petroleum deposits, belong to the Government; they are not sold but leased for 50 years, subject to a royalty of 15% on the net profit in the case of coal. All improvements are left to the Government at the expiration of the lease. From two to three years are allowed to develop the coal and to begin operation. A bond must also be given as evidence of good faith on the part of the operator. Considering the fact that there are few coal mines operating in Colombia, although the country contains vast coal deposits, these terms are onerous, and will tend to discourage development and investment of foreign capital. The difficulties and expenses incident to new enterprises in countries like Colombia, are grievous enough without being saddled with a royalty which would be considered large even in some districts of the United States. Mining machinery is admitted free from customs duties, but I do not know what restrictions, if any, surround the importation of explosives.

Regarding labor, we may turn again to Panama for comparisons, because similar climatic and ethnologic conditions exist there, and have produced like results in the way of population. The Panamanian natives have been found indifferent laborers in the work on the Canal Zone. Doubtless similar difficulties will be encountered in obtaining and retaining laborers in the unhealthy valleys of Colombia. The natives from the mountain districts in Colombia are said to be fairly good workers, but the same can certainly not be said of the valley dwellers, who have about two-thirds negro blood. The population of Colombia is sparse, and does not appear to be increasing; on the contrary, I have been told it has considerably decreased by reason of the relatively great losses of life during the revolution which occurred about six years ago. On the whole, the prospect for securing good labor for engineering undertakings in Colombia does not seem to be encouraging, and it is probable that large undertakings will be hampered unless laborers can be brought in from other countries.

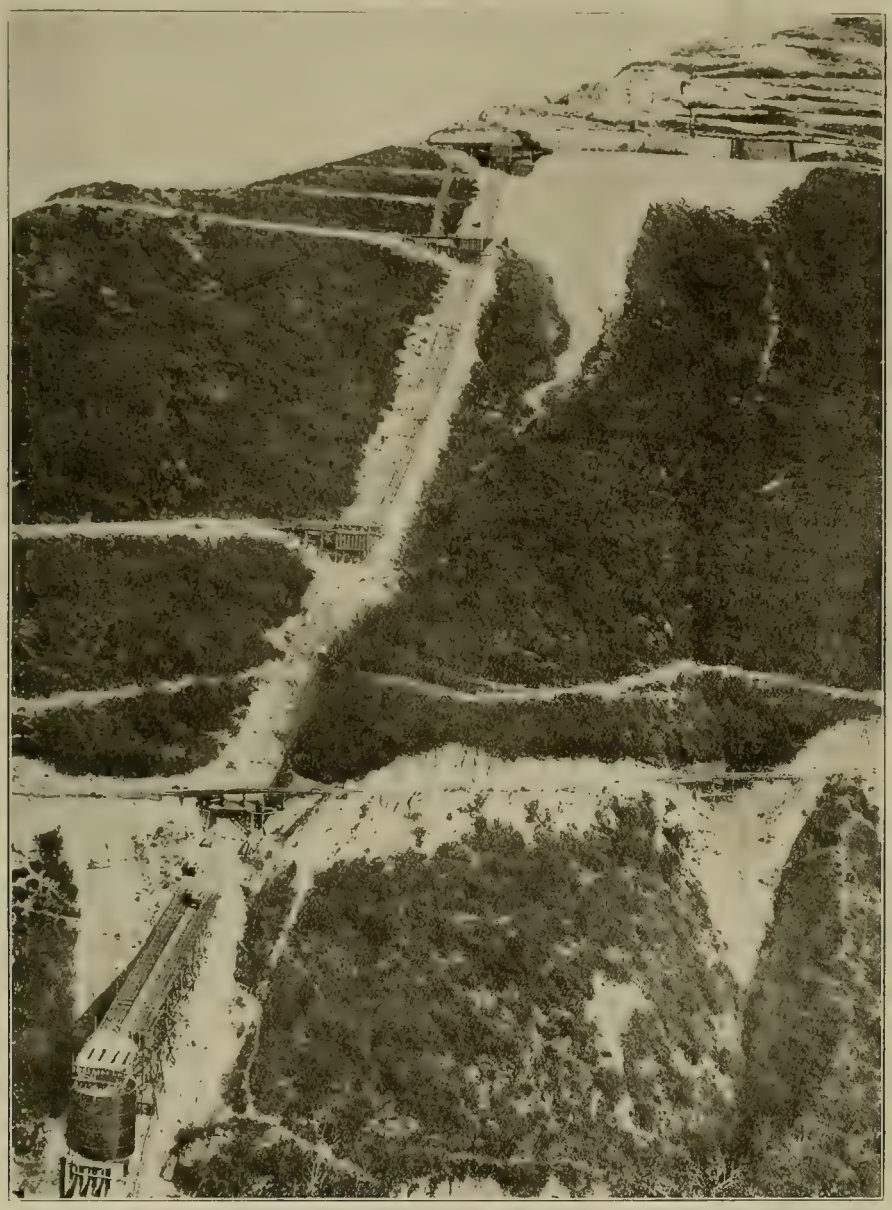
South America is pre-eminently a continent of the future, a place where the super-abundant population of Europe and North America will ultimately go. Its possibilities are enormous, and some sections could support a population as dense as that of India or China, when in the future some clever biologist succeeds in discovering an antitoxin that will destroy or neutralize malarial poisons.

Since writing this sketch an article on 'Travel in Colombia' by Courtenay De Kalb has appeared in the issue of March 6. Although Mr. De Kalb knows a great deal more about Colombia than I do, he has been polite enough to ask me for criticism of his article. The only point on which I do not agree with him is in his affirmation that the malarial mosquito is exclusively nocturnal in its flight. I have the authority of one of the most prominent entomologists in this country for the statement that the *anopheles* mosquito is likely to be about and bite in the day time, but of course it is less active than at night. This confirms my own experience, for I have been frequently bitten in the middle of the day while at work in the jungle along the banks of the Cauca river, by mosquitoes that I am sure were of the *anopheles* type. As there are 30 different species of this mosquito, it is possible they may not all carry malaria, but the entomologists tell me it is certain every one of these may upon occasion develop that tendency.

BOSTON CONSOLIDATED, BINGHAM, UTAH.

Written for the MINING AND SCIENTIFIC PRESS
By COURTENAY DE KALB.

South and southwest of the area owned by the Utah Copper Co. in Bingham canyon lies the property of the Boston Consolidated Copper Co. Unlike the Utah Copper, the Boston Con. has mines of high-grade ore—ore which is basic and rich enough to go to smelter without preliminary concentration; but it also owns a large block of the monzonite disseminated low-grade copper ore which is being so successfully worked in Bingham canyon. The Boston Con. owns the highest portion of the impregnated monzonite mass, which reaches an altitude of about 7600 ft. at the summit of the ridge. The rock in this direction is more fractured, and silicification has been a more pronounced feature of the alteration. That circumstance, however, has not been the cause of sufficient resistance to denudation to materially determine the physiography; the ridge was formed as a result of the harder quartzite which constitutes the main mountain mass. The great monzonite area exposed in Bingham canyon extends southward into the drainage-basin of Carr Fork in the form of a narrow elongation. In this are retained two large remnants of the quartzite which had been lifted up by the intrusive igneous rock. The character of the monzonite in the mine of the Boston Con. is not perceptibly different from that being worked by the Utah Copper Co., but the line of demarcation between the leached and oxidized overburden and the subjacent, secondarily enriched ores is subject to greater irregularities, the outline often being decidedly serrated.



Incline-Tramway, Boston Consolidated Mine.

The Boston Con. owns 49 acres of impregnated monzonite carrying 1.5% copper, from which an estimated production of 56,000,000 tons of ore can be derived. In addition to this, there are 107 acres of 1% ore, which may constitute a valuable asset in the future, for although immense copper deposits are being developed in many parts of the world, the exhaustion of ore that can be now profitably worked with copper selling at 12 cents per pound is proceeding so fast that the revelation of fresh resources by development has no tendency to depress the price. Whatever may be the fluctuations in copper quotations within the next few years, the future, counted in decades, must call for the utilization of ores of lower copper-content than can be mined today. This will necessitate a higher average price for the metal, unless modern improvements in mining and metallurgy reduce the cost of treatment equally with the average diminution in grade.

While the average copper-content of the orebody developed by the Boston Con. is placed at 1.5%, much ore of higher tenor exists, which is characteristic of the more highly fractured portions of the monzonite. For example, the monzonite area extends eastwardly into the ground of the Ohio Copper Co., where the silicification has been still more complete, resulting in greater irregularities in the distribution of the metal; that is, there are zones of higher concentration. It may be observed in passing that the more highly silicious ores are claimed to yield a larger percentage of extraction by concentration. The low-grade ores of the Boston Con. contain 0.25 oz. silver and 0.003 gold per ton. On the basis of 12c. copper and 75% net recovery upon copper and 50% on gold and silver, these ores would yield a gross return of $3.07 per ton, and it is safe to say that the total cost of operation will fall below $2 per ton.

The conditions presented by the monzonite orebody in the territory of the Boston Con. have led to a mining practice at variance with that adopted by its neighbor. Both caving and steam-shovel work are utilized, but with fundamental differences. The open-cast work is conducted in benches of moderate height, 50 ft. being the elevation of bank aimed at; this, however, is subject to considerable variation arising from surface-irregularities. The rock is shattered by blasts in deep holes bored by a Keystone drill. The No. 2 drill is used, and the holes are cased with 6-in. well-casing. The holes are drilled 25 ft. from the edge of the bank, so that with each blast a cube of material, approximately 25 by 25 by 50 ft., or 1158 cu. yd., is shaken. The bottom of the hole is first 'sprung', that is, chambered, with a charge of 50 lb. of 40% dynamite; a large charge of Trojan powder, consisting of 500 to 600 lb., is then introduced, and exploded electrically with 6X caps. The Trojan powder is said to be particularly well adapted to this work; it is quite insensible to ordinary shock, does not freeze, and is unaffected by moisture. The 30% grade of powder is employed for bank-blasting. The cost of drilling the holes is said to fall below 90c. per foot, including necessary renewals of casing, most of the casing, however, being recovered undamaged after each blast. At one time an experiment was make with a hole 120 ft. deep; it was blasted, with a charge of 4 tons of 35% dynamite. The method of blasting a lower bank, however, is considered more satisfactory. The excavation is done by Marion and Vulcan steam-shovels of the 95-ton type with 5 cu. yd. dippers. The company owns 4 of these machines. The usual crew of engineman, craneman, fireman, and 4 pitmen, is employed. The ore is loaded upon cars on a narrow-gauge track, and conveyed around the spur of the mountain to the mine-bin on a gradient of about 2%. The cost of the ore mined and delivered to the bin is said to average 18¾c. per ton. The use of a narrow-gauge service-railway offers some advantages over the standard-gauge employed in Bingham canyon. It necessitates less cutting for the track, and is much more flexible.

From the mine-bins the ore is sent by a gravity-tram 2100 ft. down the mountain-side to a great cylindrical steel bin at the level of the Rio Grande Western railway main tracks in Carr Fork, whence the ore is shipped to the concentrator at Garfield, 27 miles distant. The bin is constructed of ⅜-in. steel at the bottom and of ¼-in. sheet at the top; it is 60 ft. high, and 36 ft. diam. Opposite the chute, where the ore is dumped from the skips, it is faced with heavy lagging. The incline has a double track, of 3-ft. gauge. The grade changes three times in the course of the descent, beginning at 29° from the horizontal, flattening to 24, and finishing at 14. The cable is held down to a proper angle for traction by knuckle-sheaves carried on bents which straddle the track at intervals. On this tramway 12-ton skips are operated at a speed of 400 ft. per minute, and each car averages 15 trips per hour. No effort is being made to attain a high capacity at the present time, when the incline is delivering 2400 tons per diem into the steel bin, or 200 skips in a shift of 10 hours. These cars or skips are handled by a brake-system manufactured by S. B. Stine & Son of Osceola Mills, Pa., patterned after those employed in coal mines. The apparatus is simple and safe. The cable passes in the shape of a figure 8 around two drums, one 90 in. diam. and the other 110, placed tandem, making four laps around each drum. The drums are placed with their axes vertical. The faces are made broad for friction-brakes which pass around each drum, and are fastened near one edge of a disc placed between them; a partial revolution of the disc thus serves to tighten the brakes. The steel brake-bands are faced with wooden blocks set with the grain horizontal. In order to prevent glazing of the wood from the formation of carbon under the heat of friction, holes are bored through the blocks and filled with babbitt metal. This simple expedient proves an efficient remedy for the evil of carbonization of the wood. The brakes are controlled by compressed air, and a counterweight is provided which securely locks the wheels if the air-mechanism fails, or if the air-pressure falls below 60 lb. The entire system of drums and brake-device for operating this double-track incline with 12-ton skips, cost only $8500 delivered at Bingham, Utah.

On the incline are three bins, one at the top for ore mined by steam-shovel, and one several hundred feet

lower taking ore from the main tunnel, and another still farther down the mountain. A single-track electric haulage system handles the ore on the main tunnel-level. These loading bins are equipped with a simple and efficient sector-gate, which opens downward and closes upward, designed by the engineers of the Boston Con. At the constricted lower portion of the bin the ore rests upon a heavy iron casting made on the arc of a circle, with a flat plate in a position radial to the arc, so placed that it constitutes the front of the bin-gate which is closed by being moved upward, and lies flush with the inclined

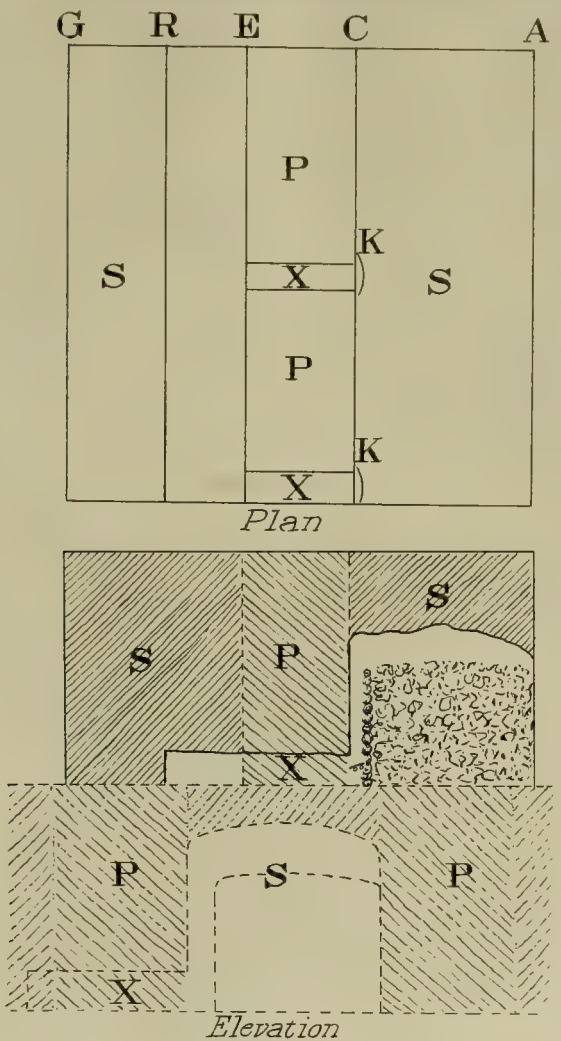


Fig. 1. System of Cave-Mining.

bottom of the bin when moved downward, forming an extension of the bottom plate of the bin upon which the ore can smoothly run when this sector-gate is down or opened. The gate is pivoted at the centre from which the arc-plate is subtended, and is operated by power applied from a compressed-air cylinder at the end of a level. The gates are 30 in. wide, and the air-cylinders, operating them, are 10 by 30 in., using air at 60-lb. pressure.

The system of cave-mining at the Boston Consolidated was elaborated by Louis S. Cates, the mine superintendent. In principle it consists in carrying up stopes 100 to 400 by 22 ft. in horizontal section, with vertical walls. Pillars 20 ft. wide are left between the stopes, and those are subsequently caved by stopes raised below until the supporting arch becomes too weak to sustain the burden. A drift is driven through the block, as shown in the plan (Fig. 1), 38 ft. from one side of the block. The drift ER is originally 6 ft. wide, and is subsequently widened to 12 ft. Cross-cuts, XX, are then driven through the ore which is to be left as a pillar, PP, to the ground which is excavated by the stope S. This area, 22 by any length up to 400 ft., is under-cut, the broken ore being trammed out. Overhand stoping then proceeds until the arch shows signs of weakening from the pressure of the pillar or the overburden above. The successive stages of the process are shown in the elevation, Fig. 1. As the pillars and stopes alternate, the relative volumes are approximately as 1 to 1.37, but as the arches above the stopes are about 8 ft. thick when caving ensues, the volume broken by caving is greater than that mined by drifting and stoping, the figures being almost exactly reversed. A series of 7

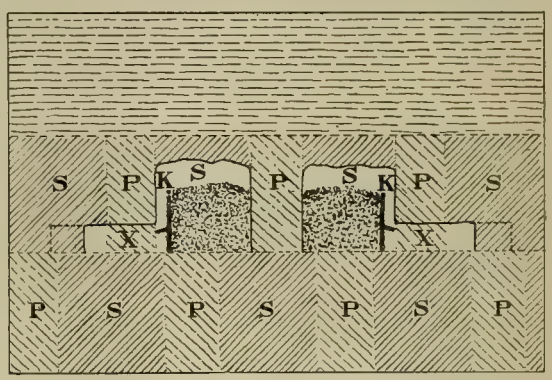


Fig. 2. Caving Large Blocks.

stopes and pillars would involve, in the collapse from caving, a total volume of about 755,000 cu. ft., with the preliminary excavation of about 68,000 cu. ft., the ratio of ore broken by caving to that won by ordinary mining rising accordingly to about 11 to 1. Stopes will be carried from the lowest tunnel, where ore is loaded in cars, up and underneath the pillars above, thus drawing all ore directly from stopes to the main haulage system. As the haulage in the main levels is done by trains operated by electricity, it is seen that the expense of handling will be reduced to a relatively small item. The volume of the ore after being broken is increased so that it would occupy about one-third more space than the original 'ore in place'. Consequently, after the first slice has been removed in starting a stope a constant distance between the broken ore and the roof is maintained by drawing about one-fourth of the material blasted.

Waugh, Leyner, Sullivan, and Murphy stoping-drills are employed, and have proved most efficient. The duty of one machine is from 20 to 25 holes, 7 ft. deep, per shift of 8 hours. The holes are drilled from 4 to 6 ft. apart. Two shifts are employed, and the holes are fired after each shift. Three machine-men and three muckers are at work in each stope. The three machine-men 'spit' the holes, which are loaded with 1½ to 4 sticks of 30% Hercules dynamite. The

fuse is cut in 7-ft. lengths, and burns at the rate of 18 in. per minute. Thus the time allowed for spitting 25 fuses and escaping to safety is 4.7 minutes. At the present time work is progressing in six stopes, and the output of the mine is 2000 tons per day, which includes ore extracted during development. The regularity indicated by the diagrams is not maintained in practice. One stope is 480 ft. long, and another is 140, with a height of 115 ft. The system

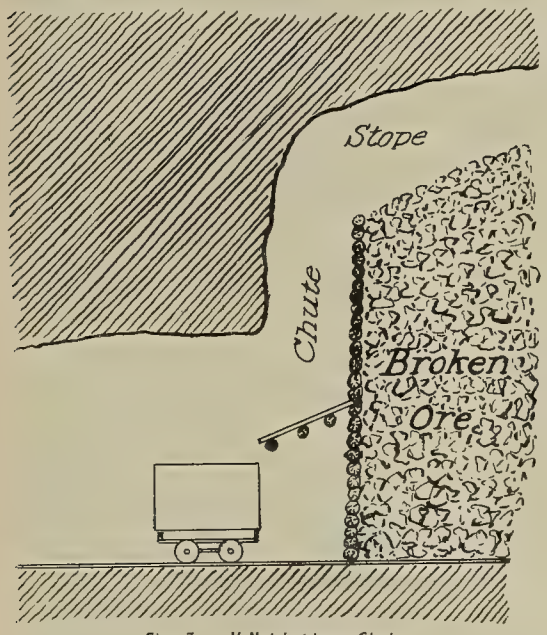


Fig. 3. V-Notch Stope-Chute.

of mining has been a process of evolution by experiment, and it has been necessary to proceed cautiously, profiting by each trial in dealing with this particular orebody. Considerable difficulty has been pre-

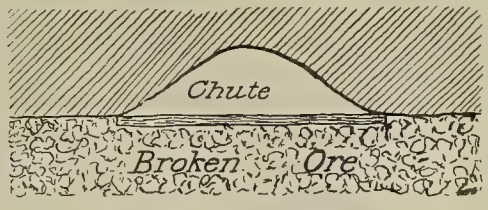


Fig. 4. Plan of Stope-Chute.

sented by the slips, which extend for great distances through the ore. These have slickensided faces, and, as is usual when such dividing surfaces are a result of alteration instead of jointure or faulting, they display a tendency to conchoidal forms.

An interesting detail in connection with the stopes is the manner of making ore-chutes. These are exceedingly simple and inexpensive. From the terminus of each cross-cut from the drift ER (Fig. 1) a shallow but wide V-notch is maintained in the wall of the pillar, about 2 ft. 6 in. wide in horizontal section (Fig. 3). Lagging poles are laid across the notch, behind which the broken ore in the stope is filled (Fig. 3 and 4). A loading-pocket is provided at the bottom of the chute, constructed at such a height as to admit of drawing the ore into a car on the cross-cut. The lagging employed is 6 in. diameter.

Miners are paid $3 and muckers $2.50. The cost for labor alone in driving levels and cross-cuts, which are 6 by 8 ft. in section, is said to amount to $2.25 per running foot. The powder used will average about ¾ lb. per ton, a ton being nearly 12 cu. ft. of ore in place.

COSTS OF DREDGING.

In a recent editorial note we referred to dredging costs. Here are the details. The costs given cover the operating expenses, the cost of all repairs necessary to keep the dredges in first-class working condition, and the cost of extraordinary breakages and accidents; all of which latter are properly included in dredging costs. Estimates of costs which do not include the last mentioned items are to that extent fictitious.

1. A dredge having 3½ cu. ft. buckets, digging in ordinarily loose gravel and sand.

OPERATING COSTS IN CENTS PER CUBIC YARD.

	——YEARS——						Average for 6
	1.	2.	3.	4.	5.	6.	years.
Labor	2.913	3.133	3.975	2.687	3.011	2.853	2.877
Power	1.886	1.960	2.467	1.542	1.446	1.487	1.655
Water		0.180	0.255	0.194	0.211	0.195	0.154
Repairs and supplies	2.415	3.383	2.624	2.515	2.395	1.717	2.480
General expense	0.745	0.658	0.797	0.672	1.354	1.077	0.825
Total	7.959	9.314	10.118	7.610	8.417	7.329	7.991

2. A 5 cu. ft. dredge, working in tight gravel and clay. The material should properly be considered as tough rather than hard.

OPEATING COSTS IN CENTS PER CUBIC YARD.

	——YEARS——				Average for 4
	1.	2.	3.	4.	years.
Labor	3.814	4.069	3.356	3.060	3.557
Power	1.912	1.815	1.622	1.425	1.687
Water	0.340	0.323	0.374	0.292	0.333
Repairs and Supplies	2.709	2.788	4.297	3.062	3.246
General expense	1.260	0.959	1.124	1.145	1.124
Total	10.035	9.954	10.773	8.984	9.947

Dredge No. 2, working in such ground as is No. 1, would operate at a total cost of about 5.59 cents.

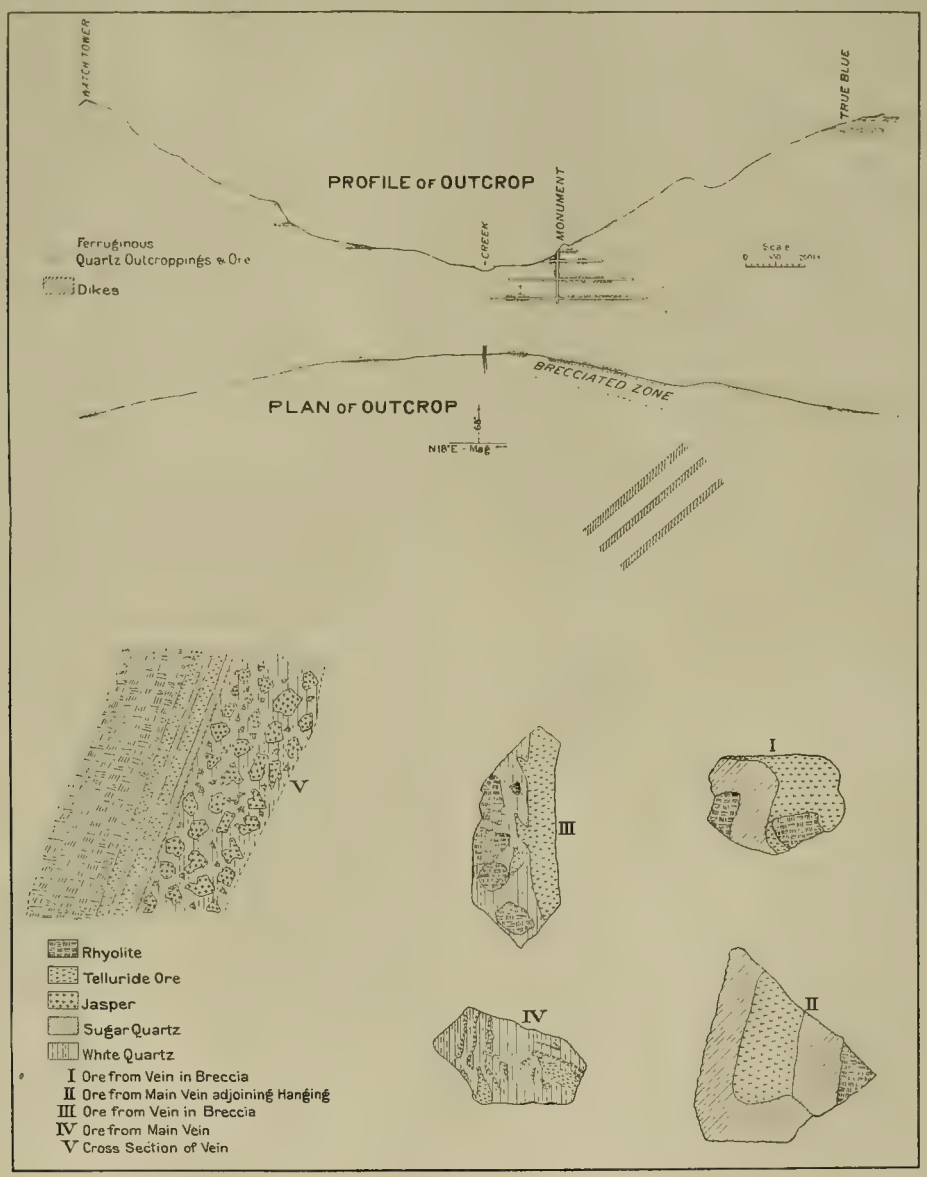
Cobalt, so closely resembling nickel in its general characteristics, does not seem to behave like it when alloyed with iron. It apparently has little, if any, effect in lowering the transformation points. Cobalt steel therefore is not self-hard, but usually is of a perlitic structure (soft). It has, however, a tensile strength rather higher than that of carbon steel, though scarcely comparable with that of nickel steel. The utility of cobalt as an alloy in high-speed steel remains to be shown.

Drying ore-samples, according to instructions issued by the United States Steel Corporation, should be done as follows: "A portion of the entire sample, reserved for the moisture-determination, in either case not less than 2 kilograms, is transferred to a suitable pan and weighed, dried at 100° C. until constant weight is obtained, and the percentage of moisture calculated."

VEIN STRUCTURE IN THE MONUMENT MINE.

Written for the MINING AND SCIENTIFIC PRESS
By HENRY C. CARR.

The mines of the Oregon Idaho Co., which are the subject of this article, are situated in Lemhi county, Idaho. They are situated in the Salmon River mountains, a branch of the Bitter Root range, the latter being the dividing line between Idaho and Montana. The mines were originally discovered by Mexicans, who worked the rich surface ores in arastras, run by water-power on what is now known as Arastra creek, which traverses the property in a general east and west direction. Practically all the work has been done on the Monument mine (see map) and it is in this mine that exist the conditions to be described. The collar of the shaft is at an altitude of 6000 ft. above sea-level; the shaft follows the vein on its dip (69° from the horizontal) to a depth of 300 ft. The locality has been the scene of volcanic and thermal activity at a geologically recent period. The country rock for a distance of 12 miles, in either a north, east, or west direction, is an acid rhyolite of Tertiary age. This rhyolite flowed from a crater, one wall of which is situated about two miles south of the mine and still has an altitude of 10,000 ft. The various flows from the crater can be seen distinctly, as watercourses have eroded their way through the rhyolite to a depth of 1000 ft. below the present mine workings. These flows follow a northerly direction and are of varying thickness, from 40 ft. upward. About two miles north from the mine is a cone of volcanic ash at least 500 ft. high and 500 ft. through at its base, while at a distance of half a mile west of the mine, intrusive dikes, thrusting their way through a hydrated volcanic sinter, have produced a fine quality of opal. The vein itself is an original fissure following a direction of N. 17° E. (Mag.) and was



The Monument Mine, Idaho.

caused by the cooling and fracturing of the rhyolite. The outcrop crosses the Watchtower, Monument, and True Blue claims of the Oregon Idaho Co. and is marked by high pillars of flinty quartz, so hard, that they have withstood the erosive action of the elements. It has an average width of 30 in. of banded structure, the bands being from 1 to 3 in. wide, very silicious (analyses, 96% SiO_2); it is a remarkable illustration of crustification. The ore occurs as bands, the valuable minerals being disseminated in minute particles through the gangue, in the form of telluride, petzite, and sylvanite. The ore shoots pitch to the north and the best ore ($100 and upward) is found following the hanging wall. This hanging wall is smooth and shows no signs of any subsequent movement in any direction; neither is there any gouge, the rich ore being frozen to this wall so tightly as to become part of it, so that a slab from 1 to 3 in. thick has to be removed by moils. It seems that the ascending hot waters, following this open fissure, dissolved part of the hanging wall adjoining the fissure, and deposited silica in the form of quartz containing the precious metals, in the place of the soluble material leached out. Successive ascending solutions followed until the fissure was filled, some of these solutions being devoid of minerals of commercial value, as evinced by bands of broken white quartz. The monument mine has no foot-wall, while the Watchtower and True Blue mines on the same outcrop (see map) have two well defined walls. In the Monument mine for a distance of 400 ft. north of the shaft and 150 ft. south, on all the levels, there is found a brecciated zone from 40 to 100 ft. wide. This zone consists of pieces of blue jasper as large as a man's head, small fragmental pieces of high-grade ore from the size of a walnut to 3 in. diam., all cemented together by a barren sugary quartz, thoroughly disintegrated. This brecciated mass, on account of the small pieces of high-grade ore, assays about $1.50 per ton, but is not of merchantable value. Cross-cuts into the breccia have demonstrated that there is no ore in it except feeders from the main vein; they are apparently offshoots of the vein and were caused by the ascending solutions following the line of least resistance along small fractures in the, then, foot-wall. The ore found in the feeders shows in every instance that it was not deposited along an open channel but as an impregnation and substitution of the country rock, because this particular ore invariably contains pieces of rhyolite, some of which is still fresh and some of it partly changed, as is shown by the sketch. To the east of the shaft and at distances of 300, 375, and 475 ft., respectively, are three rhyolite dikes having an average thickness of 40 ft. each. These dikes (see map) appear only on the north side of Arastra creek and run at an angle of 67° to the vein. If they continue below the surface as above they should cross the main vein at 800 ft. north of the shaft. They are very acid and erosion has failed to eliminate from the exposed sides the rough shearing scars showing where they were extruded through the country rock. As before stated, there are two walls in the Watchtower and True Blue mines, while the Monument has a hanging but no foot-wall. On the first two mines, the width of the vein, its gangue, and assay-value are the same as on the Monument. The map also shows that the intrusive dikes do not appear except on the Monument claim. Is it not then right to reason that there was an original fissure, filled by subsequent recurring ascending solutions, and that the veins or feeders connecting with the main vein and found in the brecciated mass were caused by these same waters altering portions of the foot-wall rocks; that these intrusive dikes were subsequent to the vein-filling and were the cause of the brecciated condition of the foot-wall side. At the same time, did not the waters which accompanied these dikes as they were extended, produce the jasper and sugary quartz by metamorphism and leaching?

FRAUDULENT ASSOCIATION PLACER CLAIM.

A case of great interest, bearing especially upon Alaskan conditions, but also touching a fraudulent practice widely prevalent in the western United States has recently been decided by the U. S. Circuit Court of Appeals, 9th Circuit (Cook *v.* Klonos, 165 Fed., 529, Oct. '08), on appeal from Alaska.

The United States Mining Statutes authorize two or more persons to jointly locate placer claims. No such location shall include more than 20 acres for each individual claimant, and cannot exceed 160 acres, in which case an association of at least eight locators is required. Such an association claim of 160 acres was located in Alaska in the name of eight locators, six of whom were absent and residents of Ohio, and prior to making the location it was understood that Barnett, who held powers of attorney from the absent locators, and who was not himself a locator, was to receive half of their interest, or the equivalent of 60 acres. The Court of Appeals held that this understanding entered into the act of entry and location, rendering it fraudulent and void as against the United States. It is interesting to note the following language of the Court: "The mineral land laws of the United States are extremely liberal in the requirements under which possessory rights may be acquired. The few restrictions imposed are only intended to prevent the primary location and accumulation of large tracts of land by a few persons, and to encourage the exploration of the mineral resources of the public land by actual bona fide locators. The scheme of using the names of dummy locators in making the location of a mining claim for the purpose of securing a concealed interest in such claim appears to be contrary to the purpose of the statute; but when this scheme is used to secure an interest in a claim for a single individual, not only concealed but in excess of the limit of 20 acres, it is plainly in violation of the letter of the law, and when, as in this case, all the locators had knowledge of the concealed interest and were parties to the transaction, it renders the location void."

The cost of producing power in small gas-power plants in the neighborhood of 100 hp. is as low as can be secured in our largest and best steam central stations.

EIGHT-HOUR LEGISLATION IN NEVADA AND CALIFORNIA.

The subjoined statutes, modeled after the law of Utah, have recently been passed in Nevada and in California. The Nevada statute, as here printed, is official. The California bill given is from the copy introduced into the Assembly on January 15, which was passed and signed by Governor Gillett. The official statute has not yet been issued:

CALIFORNIA STATUTE.

An Act regulating the hours of employment in underground mines and in smelting and reduction works.

The people of the State of California, represented in Senate and Assembly, do enact as follows:

Section 1. That the period of employment for all persons who are employed or engaged in work in underground mines in search of minerals, whether base or precious, or who are engaged in such underground mines for other purposes, or who are employed or engaged in other underground workings whether for the purpose of tunneling, making excavations, or to accomplish any other purpose or design, or who are employed in smelters and other institutions for the reduction or refining of ores or metals, shall not exceed eight hours within any twenty-four hours, and the hours of employment in such employment or work day shall be consecutive, excluding, however, any intermission of time for lunch or meals; provided that, in the case of emergency, where life or property is in imminent danger, the period may be a longer time during the continuance of the exigency or emergency.

Sec. 2. Any person who shall violate any provision of this act, and any person who as foreman, manager, director, or officers of a corporation, or as the employer or superior officer of any person, shall command, persuade, or allow any person to violate any provision of this act, shall be guilty of a misdemeanor and upon conviction shall be punished by a fine of not less than fifty dollars ($50) nor more than three hundred dollars ($300), or by imprisonment of not more than three months. And the Court shall have discretion to impose both fine and imprisonment as herein provided.

Sec. 3. All acts and parts of acts inconsistent with this act are hereby repealed.

NEVADA STATUTE.

An act to regulate the hours of employment of working men in open-pit and open-cut mines, so as to better protect the health and safety of those engaged in such work or occupation, and providing penalties for the violation thereof.

(Approved, March 5, 1909.)

The people of the State of Nevada, represented in Senate and Assembly, do enact as follows:

Section 1. The period of employment of working men in open-pit and open-cut mines shall not exceed eight (8) hours in any twenty-four (24) hours, except in cases of emergency where life or property is in imminent danger.

Sec. 2. Any person who violates any provisions of section one of this Act, or any person, persons, corporation, employer, or his agent, who hires, contracts with, or causes any person to labor in any open-pit or open-cut mines, for a period of time longer than eight (8) hours within any twenty-four (24) hours, except in cases of emergency where life or property is in imminent danger, shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than one hundred dollars ($100) nor more than five hundred dollars ($500), or by imprisonment in the county jail for not more than six months, or by both such fine and imprisonment.

Sec. 3. This Act shall take effect thirty days from and after its passage.

Spelter-production for 1908 was as shown by the following table:

Locality.	Tons. 1907.	1908.
UNITED STATES:		
Arizona	77	152
Arkansas	1,911	2,002
California	140	27
Colorado	26,077	24,885
Idaho	3,508	581
Illinois	1,446	298
Iowa	220	516
Kansas	13,850	8,628
Kentucky	358	341
Maine	1	.....
Missouri	141,824	123,655
Montana	.....	900
Nevada	1,692	398
New Jersey	13,573	6,926
New Mexico	136	134
Oklahoma	719	2,235
Tennessee	181	341
Texas	16	.....
Utah	1,972	282
Virginia	771	910
Wisconsin	15,273	17,538
Total domestic	223,745	190,749
FOREIGN:		
British Columbia	545	2,425
Mexico	25,570	17,250
Total foreign	26,115	19,675
Grand total	249,860	210,424

The production of spelter for the world in the year 1908 was 799,644 tons of 2000 lb., being a decrease from 813,842 in the previous year. Belgium stood next to the United States, contributing 181,910 tons. The third place was taken by Silesia with 158,379 tons.—U. S. Geological Survey.

Contact deposits are the chief producers of copper and iron in Mexico. The great copper mines at Cananea belong to this group, as well as most of the orebodies in the Sierra Madre Occidental, and of the interior and northern portions of the Mesa Central. While the larger portions of these deposits yield copper or iron, yet many yield lead or zinc, even of gold in association with copper. Good illustrations are furnished by San Carlos in Tamaulipas, Sierra del Carmen, Golondrinas, Mazapil, Encarnacion, Las Vegas, Aurora, Balsas, Cerro de San Pedro, and Campo Morado.

DISPOSAL OF GOLD FROM THE RAND.

By T. Kirke Rose.

*By common consent, statistics are admitted to be both misleading and dull, and the following account of the first rough distribution of the gold produced in South Africa cannot be expected to escape the common lot of such papers. Consequently I beg the Society to remember that the paper was written at the invitation of the Council, following a suggestion made by T. L. Carter. In drawing up this account I have used official publications only and have everywhere reached the limits of information almost at the beginning of the enquiry. My own private quarrel with statistics is not that they are misleading and dull, but that they always stop short before they have told what I want to know, so I am continually driven to making guesses.

The official publications consulted are the Annual Statements of Trade of the United Kingdom, the Statistical Abstracts of the United Kingdom, and of the British Colonies, Possessions, etc., and the Annual Reports of the English, French, and United States Mints.

I have considered only the period of five years, 1903 to 1907,† because during the war the production of gold in South Africa was comparatively unimportant, and the years 1899 to 1902 were abnormal in that and other respects. In a limited sense every year is abnormal. The conditions affecting the distribution of gold change continually, and it is useless, from a study of statistics alone, to hazard predictions.

At the beginning of the study of what becomes of the Rand gold, it must be premised that no distinction can be drawn between the gold from the Rand, and that from other districts. The gold from the Rand goes down to the coast and is at once, statistically speaking, mingled inextricably with that from the rest of the Transvaal and from Rhodesia. The combined stream flows into London, and there joins other streams, and its identity is lost again. Little rills flow out hither and thither and are caught up in other currents, so that by imperceptible degrees the whole world is involved. In this paper the assumption has been made that wherever two streams unite and become indistinguishable from each other, they are at once completely mixed, so that any sample, however small, contains the same proportion of each constituent as the whole mass.

When the Rand gold leaves South Africa, a slight difficulty is at once encountered, for no definite statement is available as to its destination. The declared value of the production of gold in the Transvaal and Rhodesia was, for example, £26,615,025 in 1906. The value of the exports of gold from British South Africa is given as £26,516,475 for 1906 in the Statistical Abstract. In the Annual Statement of Trade of the United Kingdom the value of the gold bullion imported into England from South Africa is not given, but only the gross weight in ounces, for example, 6,986,832 oz. in 1906. The result is that the imports into the United Kingdom cannot be identified with the exports from or the production of British South Africa. These three figures are, however, in sufficient agreement (taking the mean gold-fineness of South African bullion imported into England as 875) to justify the assumption that practically all the South African gold is exported to London. Apart from the figures, this is, of course, perfectly well known.

On arrival in London the South African gold is mixed with bullion coming from other parts of the world, and can no longer be distinguished. This matters the less for the reason that the South African bullion forms the bulk of the total imports of gold bullion, as is shown in the following table, drawn from the Annual Statement of Trade for 1907:

IMPORTS OF GOLD INTO THE UNITED KINGDOM.

Country of Origin.	1905. troy oz.	1906. troy oz.	1907. troy oz.
British South Africa..	5,833,741	6,986,832	8,012,437
British India	610,320	571,033	547,452
Australasia	972,342	729,237	803,961
Rest of world.....	664,828	805,703	1,334,608
Total oz.	8,087,231	9,092,805	10,698,458
Total value	30,114,369	33,865,361	39,956,304
Gold-fineness	876.6	876.8	879.2

In these years South African gold is seen to form 72, 71, and 75% respectively of the total weight, and judging from unofficial returns, the values were in nearly the same proportions. The bullion on arrival in London is in part refined there and in part re-exported in its unrefined state. Beginning with 1908, the Customs Establishment will publish statistics distinguishing between unrefined and refined bullion imported and exported, but no figures are as yet available. My own opinion is that about 15% of the imported bullion was re-exported in the period 1903 to 1907, without being refined in London. Both the amount and the percentage of such bullion appear to be increasing, but there is little to go upon in forming these opinions. The refined bullion is partly retained in the country and partly exported. Comparison of the total imports and exports of bullion shows:

	1903-7.	1907.
Imports	£151,973,235	£39,956,304
Exports	98,059,568	26,589,442
Excess imports	£53,913,667	£13,366,862

Here the imported bullion is divided clearly into two parts, one part required and retained in the United Kingdom, while the other part is re-exported without delay. These will now be considered separately.

Dealing first with the bullion retained in the United Kingdom, it is at once evident that most of it is converted into coin, thus:

	1903-7.	1907.
Coinage from ingots only at the Royal Mint, London	£48,944,370	£16,098,894

*Paper read before the Chemical, Metallurgical and Mining Society of South Africa, February 20, 1909.

†Difficulties with this period were encountered owing to the fact that the latest U. S. Mint Report issued is for the year ending June 30, 1906, and the latest French Mint Report is for the year ending December 31, 1906. Some of the figures given in these reports extend only to the end of 1905. The Statistical Abstracts come down to the end of 1906 only.

Some of the ingots received for coinage, however, are derived from the melting of gold coin. No exact record is kept of the value of these, but, in my opinion, it may be put at the following amounts:

	1903-7.	1907.
Ingots resulting from melting gold coin.	£1,392,000	£4,500

The coinage from refined ingots at the Royal Mint has accordingly been approximately as follows:

1903-7.	1907.
£47,552,400	£16,094,400

The rest of the bullion retained in England but not used for coinage, which amounted to about £6,361,300 for the five years 1903 to 1907, was added to the stock of bullion already in existence, or was used in the arts for the manufacture of jewelry, for gold plating, for the manufacture of gold leaf, in dentistry, in photography, and so forth.

The stock of bullion in the United Kingdom, apart from the floating stocks held by refiners and bullion dealers, is in the vaults of the Bank of England. No figures are available as to the amount so held, the Bank making known only its total stock of bullion and coin. The stock of bullion is, of course, a fluctuating amount, but any gradual permanent change is doubtless in the direction of an increase. The gold bullion and coin held by the Bank on December 31, 1902, was £27,840,385, that on January 2, 1907, £29,270,470, and on January 1, 1908, £31,602,515. For purposes of comparison, it may be remarked that the mean stock in the first week of January of the ten years 1881 to 1890 was £20,550,000. It is likely that a part of the increase shown was in the form of ingots. During the year 1907, it is quite possible that the stock of bullion was reduced.

Leaving all this on one side, therefore, we have the sum of £6,361,300 in ingots, which was all or mostly used in the industrial arts in the United Kingdom during the years 1903 to 1907. No estimates of the consumption of gold are published officially in England, though the matter will doubtless be dealt with in the forthcoming Census of Production. The total consumption for the three years 1903 to 1905, however, has been estimated by the Director of the U. S. Mint* at £7,706,000, excluding old material (remelted jewelry, etc.), but including gold coin. This seems to me, judging from returns of the manufacture of jewelry to which I have had access, to be a reasonable figure, but the annual consumption in 1906 and 1907 was certainly higher than from 1903 to 1905. The amount of English gold coin melted annually for use in the industrial arts is estimated at £500,000 at least,† its only known use being for the manufacture of wedding rings. This would leave an annual amount of about £2,000,000 to be derived from gold ingots or £10,000,000 in five years. There is here a discrepancy of nearly £4,000,000, which is most readily accounted for by assuming that the amount of British gold coin melted for use in the arts was underestimated in 1903, and that it really amounts to £1,500,000 per annum. The disappearance of immense quantities of British gold coin has certainly never been fully and satisfactorily explained. The discrepancy would be equally well accounted for by the assumption that £1,000,000 in gold coin is melted down annually in the United Kingdom and subsequently exported.

The destination of the exports is shown in the following table, which is abstracted from the Annual Statements of Trade for 1903 to 1907:

Countries to which exported.	1903-7. troy oz.	Per cent.	1907. troy oz.	Per cent.
Continent of Europe.	13,005,963	54.4	2,021,561	30.4
United States	6,063,671	25.3	3,143,700	48.1
British India	4,630,381	19.3	1,374,879	...
Rest of world.....	227,822	1.0	1,272	21.0
Total oz.	23,927,837		6,541,402	
Total value	£98,059,568		£26,589,442	
Gold-fineness	964.8		956.9	

Concerning these tables it may be observed that 'Europe' stands chiefly for France and Germany, which together take almost the whole of the exports in certain years. There are exceptional years, however, as for example 1906, when 402,559 oz. went to Russia, as against 1,140,537 oz. to France, and only 77,068 oz. to Germany.

The gold bullion imported into France for the most part stays there, the exports of ingots being inconsiderable. The bars from England form over 30% of the total imports of gold and over 40 of the imported ingots. About one-half of the imported bar gold is coined, chiefly into 20-franc pieces; about a quarter of it is employed in the industries; perhaps 5% is re-exported, and the remainder presumably goes to swell the stock of bullion in the Banque de France, which increased by about £16,000,000 in the four years 1903 to 1906.

Of the gold bullion imported into Germany, something like 20% is re-exported, a like amount is used in the industries, and the remainder is coined. The gold ingots sent to America have varied in amount more than those exported elsewhere. From 1903 to 1907 (the year of the panic) they increased steadily from 158,945 oz. to 3,143,700 oz. There was, of course, a large reduction in 1908. The mean for the five years from 1903 to 1907 amounted to over 10% of the gold deposited at the U. S. Mints. Of this total quantity, in the years 1903 to 1906, about 55% was coined, about one-seventh was used in the industrial arts, and the remainder was added to stock or exported. According to the U. S. Mint Reports, however, the ingots exported are almost invariably United States fine bars, practically never foreign ingots. Also rather more than 40% of the imported gold bars were issued for use in the industrial arts in the years 1903 to 1905. This would leave nearly 60% of the imported bars to be divided between coinage and additions to the stock of bullion in the U. S. Mints and Assay Offices. This stock is subject to great fluctuations; for example, it was $124,083,823 on June 30, 1902, $51,910,029 on June 30, 1905, and $104,383,158 on June 30, 1906. No exact informa-

*These figures are taken from the Annual Report of the Director of the French Mint. They are stated by him to be quoted from statistics published in Washington on authority of the Director of the U. S. Mint, but they do not appear in the Annual Report of the U. S. Mint.

†Annual Report of the Deputy Master of the Royal Mint, London, 1903, p. 22.

tion is available as to the stocks on January 1, 1903, and December 31, 1907, and it is better to leave this aside, as in the case of the stock of bullion in the Bank of England, and to assume that 60% of the imported bars was used for coinage. The difference between the percentage distribution of the total deposits in U. S. Mints and the distribution of the imported gold bars (of which those from England form only a part) illustrates the difficulties of this part of the enquiry, and shows how great may be the errors in the statements as to the disposal of the gold exported to France and Germany.

The gold bullion (chiefly or entirely in the form of 10 oz. fine bars) which is sent from England to India, disappears on arrival in that country, and is probably in great part converted into jewelry. As the Director of the U. S. Mint remarks, "The tide of gold and silver has been flowing into India for centuries." Probably some large hoards exist, but, no doubt, there are immense numbers of small hoards. From 1835, when the official records begin, the net imports to the end of 1906 amounted to £193,880,000, in addition to the production in India, which was £23,400,000. The world's production for the same period is estimated at £1,920,000,000, approximately 12% of which was accordingly absorbed by India.

The wanderings of the gold bullion from the Rand have now been traced as far as is practicable. Summarizing the disposal of the Rand gold for the period 1903 to 1907, the following seems to be shown:

	Per cent.
Used in coinage	58.6
Used in industrial arts	30.5
Deposited as ingots in the Bank of France	3.5
Undetermined	7.4

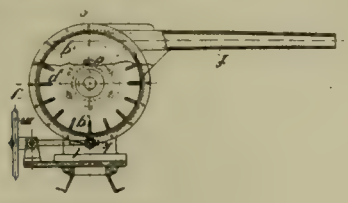
The result may also be put in the form of a bet: such as that of any particular ounce of gold produced on the Rand, it is 7 to 1 against its disappearing into India as refined 10-oz. bars, 99 to 1 against its being exported from France to an unknown destination, and 69 to 31 against its being coined at the Royal Mint.

The Trans-Siberian railway up to the end of 1903 had cost $172,525,000. From motives of economy it was laid out as straight as possible, passing 45 miles to one side of the large and important city of Tomsk, while the cities of Tcheliabinsk, Kurgan, and Omsk are all from 1 to 6 miles from their respective stations. The sation of Irkutsk is separated from the city of that name by the broad river Angara. Save for the bridges over the rivers and the tunneling around the southern end of Lake Baikal, no special technical difficulties were encountered in building the Trans-Siberian railway; in fact, those tunnels around Lake Baikal are, with but one exception, the only ones on the whole line. Since the war, traffic on the railway has greatly increased, making it one of the greatest highways of world-commerce. Through tickets to points in the Far East by way of the Trans-Siberian are now sold at all the principal European cities, and at several places in the United States. The journey between Vladivostok and Irkutsk takes four and a half days, and between Moscow and Irkutsk six and a half days, making eleven days between Vladivostok and Moscow. The journey between Vladivostok and Harbin takes 36 hr., and Peking may be reached in eighteen or nineteen days from the chief European capitals by rail. In addition to the regular Government bi-weekly Trans-Siberian express, an international 'train de luxe' is run weekly. The most important branches of the Trans-Siberian railway are those between Taiga and Tomsk, about 45 miles in length, built to connect Tomsk with the main line of railway, and from Karamskaia to Stretensk on the river Shilka, which it is proposed to continue along the Amur to Blagovestchensk and Kharbarovsk, giving Russia a trans-Asiatic railway entirely in her own territory. Nearly 200 miles of this railway is in working order, but it will be four years before it can be completed. The railway from Mikolskoe to Khabarovsk, in the Primorskaya, or Maritime Province, is 474 miles long, and is of great strategic and commercial importance.

Cyanide Poisoning.—In the Melbourne *Argus*, a writer, Orme Masson, of the Melbourne University, draws attention to the sad death by cyanide poisoning of Charles Robertson, battery-manager of the Birthday mine, Berringa, and says this is not the first time by any means that a thirsty man has thoughtlessly swallowed the contents of a beaker standing ready to his hand on the laboratory bench, and then realized, too late, that it was not water but deadly poison. "And," adds the writer, "it is certain that such accidents will happen again, and that each will cause the loss of a valuable life unless the risk be publicly recognized and counteracted. The risk arises in the first place from the fact that cyanide solutions look exactly like water. The addition of a small amount of a suitable coloring matter would be the best precaution were it always practicable, but it could not be insisted on in a laboratory. Failing such obvious methods of prevention, it is surely desirable that means of cure should be kept at hand wherever an accident is possible; and, as this can be very simply done, it appears to me that proprietors of works should be compelled by law to do it. Seven years ago the Victorian Government evidently contemplated some action of the sort, for they commissioned Dr. C. J. Martin, then professor of physiology in the Melbourne University, to investigate and report upon the antidotes for cyanide poisoning. Their experiments led me to reject certain reputed antidotes on the score of inefficiency or danger, and to strongly recommend the following mixture: 1 oz. of 23% solution of ferrous sulphate, 1 oz. of 5% solution of caustic potash, 30 grains of powdered magnesium oxide. There is every reason to believe that this mixture will prove an effective antidote if administered at once, but a very few minutes' delay must prove fatal. Martin and O'Brien therefore recommended that the materials be kept in sealed tubes which can be broken at a moment's notice, the tubes and a suitable mixing vessel to be conspicuously placed wherever they may possibly be wanted."—*Queensland Government Mining Journal.*

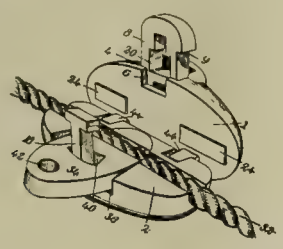
MINING AND METALLURGICAL PATENTS.

MEANS FOR CHARGING THE RETORTS OF ZINC AND OTHER ANALOGOUS FURNACES.—No. 914,339. Emile Dor-Delattre, Liege, Belgium.



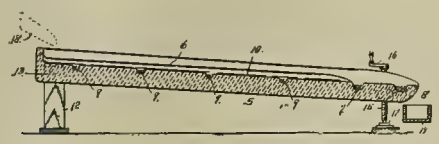
In an apparatus for charging the retorts of zinc or similar furnaces, the combination of a hopper, a motor, a conveyor comprising two rotary disks connected by a series of blades adjacent their peripheries, one of said disks being connected with the shaft of the motor, a casing surrounding the conveyer, a delivery chute communicating with the casing, and a conduit extending from the hopper through openings in the casing and one of the disks of the conveyor.

CABLE-GRIP.—No. 911,460. Thomas W. Tiley, Bellingham, Washington.



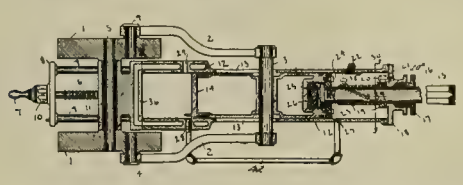
A cable grip comprising a body composed of separable sections and having a passage for the reception of a cable, a lever pivoted within said body and arranged to grip the cable, means for securing the sections of said grip about a cable, comprising a reversible member, whereby said grip may be locked or detachably secured about the cable when a load-attaching member is connected to said lever.

AMALGAMATOR.—No. 913,902. Louis C. Laurent, Denver, Colorado.



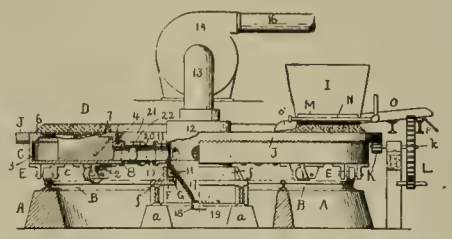
An amalgamator comprising a solid table whose upper surface is provided at intervals with mercury-containing recesses or pockets, a central longitudinally disposed rib dividing the surface of the table into two compartments, and the lower extremity of the table being provided with mercury recesses and pockets which extend the entire width of the table, the whole being composed of a solid unitary piece of glass.

INTERNAL-COMBUSTION ROCK-DRILL.—No. 915,893. Lewis L. Scott, Joplin, Missouri.



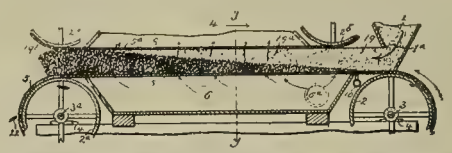
In a device of the kind described, a cylinder, a piston, a drill rod carried by the piston and working through an end of the cylinder, a ratchet rotatable loosely upon said drill rod and within the cylinder, a screw carried by the cylinder head and extending inwardly beyond said ratchet, a projection carried by said screw loosely engaging the inner face of the ratchet, a pawl pivoted by said screw and engaging the ratchet teeth, a casting forming an extension of the hub of the ratchet and extending inwardly toward the piston and inclosing a portion of the drill rod, said rod having a spirally arranged groove formed on the portion inclosed by said extension and at a distance from the ratchet, and means carried by said extension for engagement with said groove, said means being arranged adjacent the inner end of the said extension and at a distance from the said ratchet, as, and for the purpose set forth.

APPARATUS FOR ROASTING AND SINTERING ORES.—No. 916,392. Arthur S. Dwight, Joliet, Illinois.



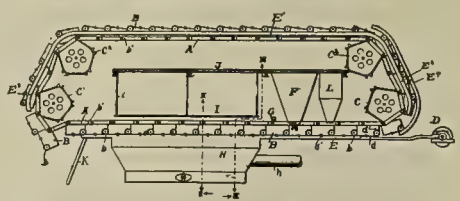
An apparatus for roasting and sintering ore by combustion in the ore mass, the combination of an endless ore support or carrier having an annular flat grate surface on which the ore rests arranged in a horizontal plane, means for turning the grate surface about a vertical axis, and means for supplying air to support combustion in the ore mass, substantially as set forth.

PROCESS OF ROASTING AND SINTERING ORE.—No. 916,396. Arthur S. Dwight, Joliet, Illinois.



The process for treating ores or metal bearing materials containing combustible elements, which consists in causing a layer or stream thereof to move continuously in one direction, igniting the combustible elements of the ore along one of the surfaces of the said layer or stratum, applying to the said surface a supporting or retaining device adapted to move therewith, delivering to the said surface air or combustion supporting gas, applying to the opposite surface of the layer or stream a supplemental retaining device adapted to restrain the particles of ore from agitation or disturbance, and causing the escape from the last said surface of the gases of combustion or reaction, substantially as set forth.

APPARATUS FOR ROASTING AND SINTERING ORES.—No. 916,391. Arthur S. Dwight, Joliet, Illinois.



In an apparatus for treating ores, substantially as described, the combination of a movable ore support adapted to carry a bed or layer of ore, air inducing apparatus on one side of the ore support adapted to cause currents of air to pass through the ore mass, and a hood or reflector for the heat arranged adjacent to the ore mass and substantially parallel with the line of travel thereof and on the side of the ore support opposite the said air inducing apparatus; also means for supplementally feeding a layer or stream of material to the support in contact with the layer or stream of ore, substantially as set forth.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

GEOLOGY OF THE GOLDFIELDS OF BRITISH GUIANA. By J. B. Harrison. 8vo., pp. 320, Ill., Appendices, Index. Published at the Direction of the Government of British Guiana by Dulau & Co. London. 1908.

The coast of British Guiana is a low alluvial plain, traversed by lines of sand dunes. The marine alluvium has been proved to depths of over 200 ft. From some of the bore-holes gases, particularly rich in methane, were given off in large quantities, and in a few cases petroleum was found. This petroleum is manifestly of extremely recent origin. British Guiana occupies one of the most stable areas of the earth's surface, which has for ages been free from volcanic disturbance, although it has been slowly rising, thus resembling Atlantic Coast conditions in the United States, where the streams are navigable only a relatively short distance from the sea before rapids are encountered. Here the rocks of the country are first found. The interior of British Guiana is covered to a large extent with sandstones and conglomerates, through which are many dikes of diabase, which occurs chiefly in belts, striking from northwest to southeast, constituting important mountain masses in the Eagle mountains in the Potaro goldfield. The clastic deposits previously mentioned constitute the greater part of the Pacaraima mountains, and spread westwardly into Venezuela. Similar rocks are found in the State of Amazonas, Brazil, extending as far south as Obidos, on the river Amazon. These deposits are referred to the Cretaceous, and that proves the diabase intrusives to be probably Tertiary. Granites are sparingly found, these containing black mica, partly replaced by hornblende, with relatively abundant triclinic feldspars. Beautiful exposures are found at the Paiwori-Cayra rapids on the Essequibo river. Through a large part of the Colony are also found quartz-porphyries, felsites, and sericite schists, which have to a great extent been chloritized. The fundamental geologic complex of British Guiana consists of gneissoid rocks, including epidiorites and hornblende schists, quartz-diorites, amphibolites, and altered gabbros. These have all been subjected to dynamic metamorphism, converting them into foliated rocks. There is great complexity in the strike of the foliation. The work before us gives an admirable review of the geologic history of the area under consideration, which will be of great service to anyone interested in the geology of the whole of northeastern South America. The petrography of the country is the subject of a number of interesting chapters, handsomely illustrated. Indeed, the book is lavishly illustrated throughout with beautiful artotype reproductions in sepia. These reveal not only the geology, but the mining methods, and the general scenery. The gold-bearing veins are mostly of quartz, locally called 'reefs', occurring for the most part where the country consists of gneiss traversed by belts of epidiorite, or of hornblende or chlorite schists, through which numerous intrusions and outbursts of diabase have taken place. The chief districts are the northwestern, near Arakaka; the Cuyuni River, Mazaruni-Puruni, Essequibo, Potaro, and Demarara. The accounts of the occurrences given by Mr. Harrison are extremely full, and will be of great interest. He accepts J. E. Spurr's explanation of the origin of the gold deposits of Guiana, only to a limited extent, as applying to the Omai district, but not to such as those in Potaro, Puruni, and Cuyuni. Spurr held that the gold ores in British Guiana represent one of the closing phases of the great granitic intrusions, and that the basic dike-rocks, with which the gold-ores are associated, as well as the silicious dikes with which they are also related in many places, are representatives of the general process of granitic intrusion, earlier than the veins but subsequent to the main intrusion. A great many of the alluvial concentrations have apparently come from solution of the gold in the waters of the soil-covering, and re-deposited in laterite and ironstones. The evidence of this remarkable process is given in detail and with great conclusiveness. Among these proofs is offered the result of experiments with woods grown on the laterite deposits, in which the ash of the bark, constituting 4.78% of the original weight, yielded on assay one grain of gold per ton, while the ash of the wood, representing 0.67% of the original weight, assayed from 7 to 10 grains per ton. There is a chapter on the diamantiferous areas of the colony. The diamonds are found mostly in gravel deposits, but have also been discovered in residual soils from the decomposition in place of gabbro and diabase. These were mostly very small, averaging about one fiftieth of a carat. The volume contains historical chapters by Frank Fowler and C. Wilgress Anderson, with an appendix giving the laws and regulations governing the mining industry in British Guiana.

ECONOMIC GEOLOGY OF THE GEORGETOWN QUADRANGLE, COLORADO. By J. E. Spurr and G. H. Garrey, with GENERAL GEOLOGY by S. H. Ball. U. S. Geol. Sur., Prof. Pap. 63. pp. 423, plates, figures, and maps. 1908.

The Georgetown quadrange includes a portion only of Clear Creek and Gilpin counties in Colorado. Nevertheless this is much the most complete report available on these old and famous mining areas. Mr. Spurr wisely refused to be bound by the artificial limits of the quadrangle and has discussed the geology and ore deposits of the region in their broader relations. Indeed, the report deals, in outline, with the ore deposits of Colorado as a whole, and will serve a useful purpose in that connection. The rocks of the area, with the exception of porphyritic dikes of probable Tertiary age, are considered to be pre-Cambrian in age. The oldest gneisses and schists are believed to have resulted from the metamorphism of a sedimentary series. These have been folded, sheared, and injected by a series of granular pre-Cambrian igneous rocks. The veins are divided into silver-bearing, predominant near Georgetown, and gold-bearing, found mainly around Idaho Springs. The former are believed to be related to veins occurring in a great belt from Boulder county, through Georgetown, Leadville, and Aspen, to the San Juan. Throughout this belt the ore deposits have many common features, including particularly relationship to monzonitic intrusives. Contrasted with them are the gold-bearing veins, most of which are connected with isolated volcanic eruptions. Silver Cliff and Rosita, and Cripple Creek are the best known examples.

The argentiferous silver-lead deposits within the Georgetown quadrangle contain chiefly galena, blende, and pyrite, with quartz as gangue. Probably the gangue-minerals are derived from the wall rocks, and a large part of the vein-material is immediately due to precipitation from ordinary surface waters. The original derivation of the metals is not shown by this study. The primary deposits consisted of predominant blende, with galena and pyrite. These were laid down through a considerable vertical range. The veins have been actively eroded, and descending waters have enriched the upper portions. The veins now exposed represent enriched roots, or secondary veins formed below the original root.

The auriferous veins consist essentially of pyrite with quartz gangue. The pyrite contains gold with copper and silver. Galena and blende are present in varying quantity. Their deposition closely followed the intrusion of certain dikes containing fluorite, and representing the pneumatolytic stage. It appears probable that these mineralizing waters and the contained gases were of magmatic origin. The hot springs at Idaho Springs have also been studied. It appears probable that the bases in solution are derived from dissolution of the wall rock. The acids are regarded as having been given off from portions of the alkaline syenitic magma, still cooling in depth. The water is regarded as of magmatic origin.

ANNUAL REPORT OF THE BUREAU OF MINES OF ONTARIO FOR 1908. Issued by the Department of Lands, Forests, and Mines. Toronto, Canada.

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EDITORIAL.

FRAUD ORDERS have been issued by the Postmaster General, forbidding delivery of mail or payment of money orders to W. W. Degge, and the various Wellington companies of Colorado. Thus the field of opportunity for making mushroom millions is ruthlessly restricted.

COPPER-STOCKS are estimated to exceed 182,000,000 pounds, which is 18 per cent of the total annual production for the United States. The contribution for the month of March to this surplus was approximately 8,350,000 pounds, which was 7.5 per cent of the total monthly output. It is evident, therefore, that the stocks of marketable copper are not accumulating at an increasing rate.

WHAT the public thinks of the great financial leaders is shown by the heavy oversubscription of the $10,000,000 of stock in the International Smelting & Refining Company. Regardless of affiliations which have been condemned from ocean to ocean, and warned by graphic tales of the gentlemanly highwaymanship of some of the leading figures, the public believes that success lies in the company of the successful; and as soon as the stock was quoted on the Curb it leaped to 140. Those who wished to make a quick turn surely were rewarded for their faith.

IMPROVEMENT in railway earnings in New England has peculiar significance. Industrially this region stands between the producer of raw material and the consumers of finished products. An essentially manufacturing community, it plays in the economic world somewhat the rôle of a hydraulic equalizer. Hence rise and fall of the level of its trade indicate widespread tendencies. The New York, New Haven & Hartford Railroad Company has announced that the earnings during the last nine months have recouped the losses for an equal period in 1907. The only point where depression appears to be persistent is in the brass-manufacturing district of Connecticut.

BROKEN HILL, with its great reserves of ore, has been something of a menace to lead and zinc producers of recent years. According, however, to the testimony of G. D. Delprat before the Federal Arbitration Court at Port Pirie, there are only two and three-quarter million tons left in the Proprietary mine. Production has recently been at a rate of five hundred to six hundred thousand tons. It is clear that at this rate the known reserves will be quickly exhausted, and Mr. Delprat does not expect any appreciable additions to be discovered. The ore averaged 13.35 per cent zinc, 13.3 lead, and 11.3 ounces silver for the first half of 1908. Government

estimates made in January 1907 give a total reserve of more than seven million tons held by seven other Broken Hill companies. Against this must be offset the production since that date.

STANDARD OIL met a worse rebuff than was administered by Judge Landis when the New York Curb demanded full financial statements from companies whose stocks are there listed. It is possible that an invidious distinction would be made? Specific differences in the breeds of the devouring beasts should not dispose the public to indulge the appetite of the cormorant to the exclusion of the wild-cat.

A DENVER OFFICE of the U. S. Geological Survey is to be established that will form a permanent Western headquarters. This marks a return to certain older plans and ideals, and is a welcome announcement. When, in earlier days, Emmons and Cross made their headquarters at Denver, and the Colorado Scientific Society met in the Survey office, the personal contact between the officers of the Survey and the practicing engineers was constant and helpful. An office there now ought to be even more beneficial, but to realize the full benefit of the plan it will be necessary to detail a certain number of high-grade men under an officer of real influence having some independent authority. Helpful as it will be to have in the mining region a supply of documents available for prompt shipment, and much as it will facilitate public business to have a local paymaster and a force of clerks, something more is needed. The West requires closer contact with the Survey, and the Survey has something to gain by more than a summer's contact with the West. We extend congratulations to the Director.

Lanyon Zinc Failure.

Appointment of a receiver for the Lanyon Zinc Company just now may have an important influence on tariff legislation. This company has been one of the larger importers of ore, and was one of the pioneers among Kansas smelters in using Western zinc ores. The application for a receiver is a concrete and appealing bit of evidence that the margin in zinc smelting has been growing narrower. The low price of metals, and the changes in customs regulations, have been particularly severe on this company, since it is more of a buyer than a producer of ore. Its business in recent years has consisted largely in handling low-grade material containing precious-metal residue. It is said that no interest has been paid on the bonded debt since 1905, and that the amount now due is $483,000. The Lanyon Zinc Company was formed in 1899 by consolidation of the Robert Lanyon Sons Spelter Company, with plants at Iola and La Harpe, and the W. & J. Lanyon works at Iola and Pittsburg, Kansas. Eastern capital was brought into the business and, under the management of Mr. Joseph Cappeau came the long and bitter litigation over the Brown-Ropp furnace patents and the resulting development of the Cappeau furnace. It will be recalled that the Lanyons themselves have been connected with American zinc-smelting from the early days. Robert Lanyon was one of the pioneers at Mineral Point, Wisconsin, and began work when Matthiessen, Hegeler, and the Jones brothers were laying the foundation of American zinc-smelting. Later Lanyon operated at La Salle, Waukegan, and at various points in the Missouri-Kansas district. At first coal-fired furnaces were employed, but after 1895 gas was used. The Lanyons were, in fact, the pioneers in using gas for zinc-smelting in the Kansas field, but with this exception the family has not been noted for its contributions to technical progress. In general they have been shrewd traders; builders of furnaces which after a while have usually been sold to the 'trust' dominant at the time. The Waukegan works were sold with good profit to the Mineral Point Zinc Company, and when in 1896 the Cherokee-Lanyon Zinc Company was formed, the family got rid of a number of small coal-fired smelters and began building in the gas belt. Certain of the Lanyons are now interested in building up a zinc-smelting industry at Bartlesville, Oklahoma. Doubtless in time the new furnaces will be ready for consolidation and sale. Meanwhile the Eastern stockholders of the present Lanyon Zinc Company, beset by difficulties on all sides, and with no interest since 1905, can hardly be blamed for having failed so opportunely.

Farmer v. Miner.

Agriculture and the mineral industry are contentious consorts. Mr. Daniel Guggenheim is reported to have recommended to anyone seeking the excitements of litigation, that he establish a smelter in a farming community. The problem of stream-pollution is becoming as serious as that of smelter-smoke. To the famous débris cases of California, the Highland Boy Gold Mining case in Utah, and that of the Bunker Hill & Sullivan in Idaho, is added the Arizona Copper Company Limited *v.* Gillespie, just decided by the Supreme Court of Arizona. Gillespie in a test case sued for and obtained a perpetual injunction. He was the owner of 267 acres of alfalfa land in the upper Gila valley; agriculture was being conducted under like conditions on 23,000 acres, dependent upon irrigation for productivity. Ranching and mining were begun simultaneously in 1872. In 1882 a concentrator was erected, throwing its refuse into San Francisco river and Chase creek, tributaries of the Gila above the town of Morenci. The pollution of the stream caused serious damage during the season of low water. The slime and slickens from the concentrator formed an impermeable crust over the soil, choking the growth of vegetation. The respective populations interested were 8000 dependent upon agriculture and 12,000 upon mining, while the disproportion between the capital invested was even greater. The decision was a victory for the farmer.

Three great principles seem to be on trial. These are the utilitarianism expressed in the doctrine of "the greatest good to the greatest number;" the principle of the inviolability of private right; and, by implication, the question of practically unrestricted application of the right of eminent domain.

It is conceivable that we may be at the parting of

the ways. Two courses of development lie open, as they did to the onward and upward growth of life: the skeleton may cling to the exterior as a restricting envelope and lead to a well methodized ant-hill, or it may retreat within and leave a flexible organism having no narrower limitations than the universal dominion of the human intellect. The question is—which represents the flexible course of progress, and which the repressive crust, in the social evolution? If the law insists upon the exaltation of the unit, the mass should logically become a body of exalted units; if the stress be laid upon mankind collectively—who knows what will become of the unit, and who can predict the character of the social result? No questions of more serious import rest upon us for decision; furthermore, without being able to properly weigh the consequences, we are deciding these questions daily, and our judges are giving interpretation to the laws that will crystallize custom from which there can be no escape.

The cleavage between the two phases of judicial thought touching the question is sharp and clean. The Arizona Court has held to the viewpoint of the California and Utah benches, proclaiming the indefeasible right of the individual. The principle of comparative injury set forth in the Mountain Copper, the Bunker Hill & Sullivan, and the Anaconda cases was flouted, and the language of Judge Sawyer (Woodruff *v.* North Bloomfield Gravel Mining Company, 18 Fed. 753) was quoted with approval: "It is by protecting the most humble in his small estate against the encroachments of large interests that the poor man is ultimately to become a capitalist himself;" and again, the rule laid down in McCleery *v.* Highland Boy Gold Mining Company (140 Fed. 941) was re-affirmed in the words, "public policy is more concerned in the protection of individual rights than in the profits to inure to individuals by the invasion of those rights." Finally the Arizona Court declares as its independent view that "to withhold relief where irreparable injury is and will continue to be suffered by persons whose financial interests are small in comparison to those who wrong them, is inconsistent with the spirit of our jurisprudence."

That is certainly true of the historic spirit of our jurisprudence. We cannot conceive Chief Justice Marshall ever entertaining the contrary opinion. It was through accentuation of the right of the individual that liberty and progress led up to the founding of the free institutions of the New World. The subduing of a continent was achieved under the inspiration of men filled with the self-reliant manhood that comes from magnifying the importance of the individual. The complexities of modern industrial growth have led in later years to a sharp challenge of the individual prerogative. The right of eminent domain is constantly evoked to further the legitimate interests of society. To permit a company to pollute a stream, doing continuous damage to a certain group of individuals because a greater number would be benefited by the operations of the company, is tantamount to expropriation. Judge Hunt affirmed (Bliss *v.* Anaconda Copper Mining Company, Fed. Rep. Vol. 167, p. 342) that the injury to a large population would suffer to such an extent by granting an injunction against the Anaconda smelter as to compel adjustment by resort to the customary legal remedy for damages. He sought, however, to so frame his decree as to avoid the destruction of the rights of either litigant. Nevertheless he has re-affirmed the principle that the magnitude of capital should weigh in the decision. Manifestly mere disparity is an uncertain basis, and would not be recognized except for the number of individuals dependent for a livelihood upon the respective industries.

In California the question was fought long and bitterly between the hydraulic miners and the farmers. The contest was finally settled by the intervention of the Federal Government under its constitutional authority over navigable waters. It was a death-blow to a great industry, because the provisions for regulating hydraulic mining could not be made effective without more knowledge and experience of restraining dams and of the transporting of sediments by running water than then existed. Indeed, after four years of experimental work under Mr. G. K. Gilbert of the United States Geological Survey the California Débris Commission, for which the investigation is being made, is not ready to announce conclusions, so difficult are hydraulic problems. The law in the case, however, was stated in unambiguous terms: One may not deprive another of the enjoyment of his rights; the mere effort of one who infringes the rights of another to abate the nuisance does not exonerate him from responsibility; and finally, the doctrines of prescriptive right to commit a nuisance and of 'necessity', that is, inability to conduct a business without committing acts objectionable to others, have no application.

As opposed to this is the opinion of the Supreme Court of the United States in a case which is often cited (New York City *v.* Pine, 185 U. S. 93), dissolving an injunction which had been obtained against the City of New York. A dam was being constructed to impound the waters of Byram river, a stream flowing from New York into Connecticut, with the intent to use the waters in the metropolis. The contest was based on the common law principle of riparian rights. Mr. Justice Brewer delivered the decision, holding that "if the plaintiffs had intended to insist upon their strict legal rights they should have commenced at once before the city had gone to such great expense." A distinction was drawn between stating a right with proffer of a waiver for compensation, and stating a right with a demand that it be respected. Thus the question of diligence is introduced, which is a prime requisite of equity. "He who seeks equity must do equity." The man who allows without protest investment to be made by another that will result in certain consequences which can be foreseen, may lose the right to equitable relief. He may have a remedy for damages which can be appraised, but it seems manifestly unfair that under such circumstances the right of one person should be extinguished for the benefit of another. In the application of the principle of due diligence lies a safeguard of both public and private advantage.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

H. C. Hoover is in Korea.

Charles Butters is at Goldfield.

W. L. Leland is in San Francisco.

Curtis H. Lindley is at Salt Lake City.

J. Power Hutchins is in San Francisco.

W. DeL. Benedict has returned to New York.

Elwyn W. Stebbins has gone to Oaxaca, Mexico.

D. W. Brunton sails from New York for Europe today.

H. G. Denny will make his headquarters hereafter at Oaxaca, Mexico.

Morris P. Kirk, of Salt Lake, is making some mine examinations in Arizona.

A. F. McEwen is manager for the Jacobs Exploration Co., Ltd., at Cobalt, Ontario.

Groch & Groch have opened an office as consulting engineers, at Cobalt, Ontario.

G. K. Gilbert has gone to Jackson, Michigan, where he will henceforth make his home.

Douglas Waterman has gone to Oroville, and thence will go to Plumas county, California.

Frederick H. Morley, of Denver, is examining mining properties near Prescott, Arizona.

John Cooper is superintendent of the El Oro Mining & Railway Co., Ltd., at El Oro, Mexico.

F. Clemes Smith is general manager for the Superior Copper Co., Algoma district, Ontario.

J. F. McClelland, of Stanford University, is giving a course of lectures in mining at Yale.

Lochiel M. King has moved his metallurgical laboratories to 518 California street, San Francisco.

T. A. Rickard delivered two lectures on the valuation of mines, at Stanford University last week.

E. McCormick is examining mining property in the Clifton-Morenci and Globe districts of Arizona.

Arthur S. Dwight has been appointed manager of the Humboldt smelter, Yavapai county, Arizona.

W. B. Milliken is president and general manager of the Indiana-Nevada Mining Co., Pioneer, Nevada.

H. C. Bellinger has been made metallurgical director of the Cobar copper mines in New South Wales.

H. S. Abbott has been making an inspection tour of the A. M. Gilbert Co. holdings in California and Nevada.

George D. Reid is examining mines in the Snake River district, Oregon, and the Seven Devils district, Idaho.

F. C. Knight, formerly metallurgist at the Garfield plant of the A. S. & R. Co., is in charge of a copper smelter in Siberia.

A. V. Thorns has resigned as manager of the Manley properties at Hot Springs, Ark., and will open an assay-office at Fairbanks, Alaska.

J. E. Clark, formerly mine surveyor and assayer for the Monica Mines Co., is with the Golden Star Mines & Milling Co., at Kofa, Arizona.

Diódoro Sanchez, official representative of the Sociedad Columbiana de Ingenieros, touring the world in the interest of the industrial development of Colombia, was in San Francisco.

Robert Hawxhurst, Jr., remains in Chile as general manager for the 'Poderosa Mining Co., of London, which has acquired the properties of the Compañia Minera de Collahuasi, Chile.

The Pacific Coast Section of the M. & M. Society will meet Tuesday evening, April 27, following dinner at the St. Francis hotel. M. L. Requa will report on his conference with the Eastern officials of the Society.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, April 22.

Antimony	12—12¾c	Quicksilver (flask)	44—45
Electrolytic Copper	15¼—16½c	Spelter	6¼—7c
Pig Lead	4.40—5.35c	Tin	32—33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 15. £ s. d.	Apr. 22. £ s. d.
Camp Bird	1 2 9	1 3 9
El Oro	1 5 0	1 4 9
Esperanza	2 17 6	2 16 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 10 6	0 11 6
Mexico Mines	5 7 6	5 12 6
Tomboy	0 18 9	1 0 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING QUOTATIONS—NEW YORK.

	Closing Prices. Apr. 15.	Apr. 22.
Amalgamated Copper	76¾	76¼
American Smelting & Refining Co	88⅛	89½
Boston Copper	11⅝	11¾
Butte Coalition	24	24
Cumberland-Ely	7⅜	9⅝
Dolores	5½	5½
El Rayo	3	2⅝
Giroux	8	8
Greene-Cananea	10½	10
Indiana Sonora	3¾	3¼
La Rose	6¾	6⅞
Miami Copper	14⅝	14¾
Nevada Consolidated	20⅛	20¾
Newhouse	2⅞	2⅞
Nipissing	10⅜	10⅜
Ohio Copper	6⅜	6⅛
Tennessee Copper	41½	41¼
Utah Copper	43¼	45¾
Yukon	4⅜	4¼

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. April 22.		Closing Prices. April 22.
Adventure	8	Mass	8¾
Ahmeek	155	Mohawk	60½
Allouez	38½	North Butte	62
Arcadian	4½	Old Dominion	51½
Atlantic	11	Osceola	129
Calumet & Arizona	99½	Parrot	33
Calumet & Hecla	605	Santa Fe	2
Centennial	31	Shannon	14
Copper Range	77	Superior & Pittsburg	13
Daly-West	9½	Tamarack	70
First National	6	Trinity	13¾
Franklin	15	United Copper Con	11¾
Granby	95	Utah Con	40¼
Greene-Cananea, ctf	10	Victoria	4½
Isle Royale	23	Winona	4¾
La Salle	14	Wolverine	143

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, April 22.

Atlanta	$ 15	Midway	$ 30
Belmont	1.10	Montana Tonopah	68
Booth	23	Nevada Hills	1.30
Columbia Mtn	17	Ophir (Comstock)	1.20
Combination Fraction	1.12	Pittsburg Silver Peak	62
Daisy	44	Rawhide Coalition	36
Fairview Eagle	30	Rawhide Queen	30
Florence	3 45	Round Mountain	90
Goldfield Con	8.30	Sandstorm	14
Gold Kewenas	16	Silver Pick	26
Great Bend	17	St. Ives	13
Jim Butler	16	Tonopah Extension	53
Jumbo Extension	17	Tonopah of Nevada	7.00
MacNamara	31	Tramp Con	7
Mayflower	10	West End	32

L. Vogelstein & Co., New York, give the following figures of German consumption of foreign copper for the months of January and February, 1909:

	Tons.
Imports of copper	23,207
Exports of copper	1,087
Consumption of copper	22,120

As compared with consumption during the same period in 1908 of 28,404 tons. Of this quantity 21,660 tons were imported from the United States.

General Mining News.

ARIZONA.

GILA COUNTY.

Development at the Inspiration mine, near Globe, is well under way. The work consists of the driving of two cross-cut adits and one drift, all in low-grade sulphide, and the sinking of two shafts, which are now 50 and 60 ft. deep, respectively; the 50-ft. shaft is in oxidized ore. Gasoline hoists are being installed at these shafts. The Banker adit, which is in 2% sulphide, will open the mine 200 ft. deeper than the present workings. Two Star churn-drills have been received and will be used in prospecting the Inspiration ground. A. F. Holden is one of the directors of this company, George E. Gunn is manager, and Henry Krumb, consulting engineer.——The National Mining Exploration Co. is grading for a 3-compartment shaft for the development of its Iron Cap property. This shaft is situated on the Free America claim, about 3000 ft. northeast of the Iron Cap shaft and 1200 ft. west of the Eureka shaft of the Arizona Commercial.——The Superior & Boston has resumed sinking the winze in the bottom of the Great Eastern mine, and samples have been taken averaging 12¾% copper, which give the consulting engineer, Frank H. Probert, the impression that the zone of secondary enrichment is being entered.

MOHAVE COUNTY.

The Arizona Excelsior Dredging Co. is being formed, to put a dredge on 640 acres of ground at Las Vegas Wash. The officers of the company are A. B. Call president, J. R. McDonald general manager, and H. J. Meyer secretary.—— The Colorado River Dredging Co. is making good progress with its Dubois dredge in El Dorado canyon.

PINAL COUNTY.

Since March 15 the management of the Ray Consolidated Co. has added 4,300,000 tons to the probable ore reserves, as indicated by the churn-drills. This has been carried out under the supervision of H. Krumb. George O. Bradley is to take charge of construction of the concentrating plant, which is to be designed from the data obtained in the 200-ton experimental mill, now in successful operation.

About 800 tons of ore per day are being received at the plant of the Southern Arizona Smelting Co. from the Imperial mines, 14 miles south of Sasco. The two furnaces have been operated continuously during the past six months, and one of them has been working constantly for more than a year. The management is considering the installation of a third furnace, and this will probably be started during the present year.

CALIFORNIA.

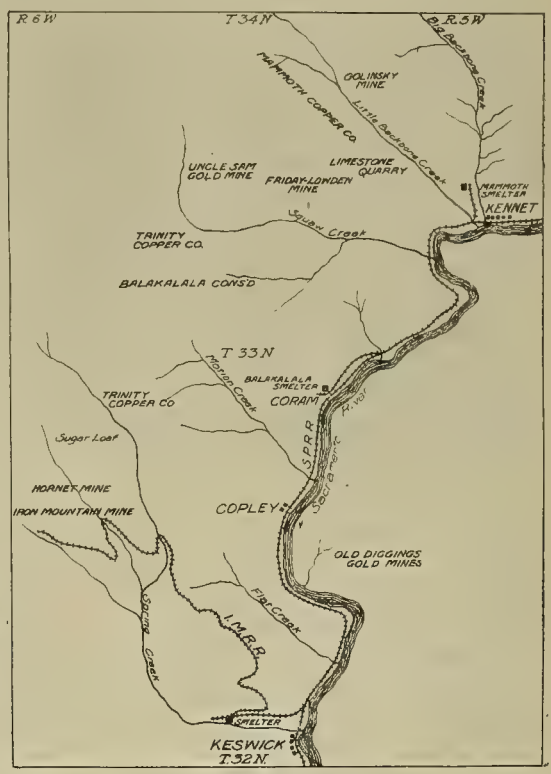
AMADOR COUNTY.

(Special Correspondence).——The new station at the 1950-ft. level of the Bunker Hill mine has been completed, and extensive developments will be shortly instituted from this point. Large reserves of ore are in sight and the mill is running steadily. The company declared its regular monthly dividend on April 15.——A large vein of milling ore is being worked on the 3150-ft. level of the Kennedy. Work is about to start at the shaft, which will be sunk to a depth of 3350 ft. A large force of men is at work in the mine and mill.——The installation of an air-compressor and other machinery has been completed at the Original Amador, and work is about to be pushed on a comprehensive scale.——At the Argonaut over 100 men are working, and a considerable quantity of good-grade ore is being milled. Developments in the lower levels continues satisfactory. R. S. Rainsford is superintendent.——One giant is breaking down the big bank of gravel at the Garibaldi and several small nuggets and much fine gold have been extracted. Restraining dams prevent the escape of debris to the rivers.——A deed of redemption, releasing the liens held against the California Con. G. M. Co., owners of the Wildman-Mahoney and other mines at Sutter Creek, has been filed by a local attorney. The amount involved is said to approximate $23,000. The filing of this deed is considered an indication that the company is contemplating a resumption of early activity.—— The Tennessee mine at Pine Grove has been re-opened and orders have been placed for a roller mill. W. A. Salisbury of Oakland is superintendent.——The shaft at the Central Eureka is down 2200 ft., and is expected to reach the level of the old workings within a few weeks.——At the South Eureka several men are working, and a daily shipment of ore is being made over the aerial tram to the Central Eureka mill. Twenty stamps are dropping.

Jackson, April 17.

ELDORADO COUNTY.

Two hundred acres of ground have been taken up in the old Spanish Dry Diggings near Greenwood, which have only been worked in a desultory way since hydraulic operations in the eighties. There is an abundant tonnage worth about $3 per ton, and about 375 ft. of adit and other development work have been done. It is intended to treat the product in an 80-ton plant designed by the Joshua Hendy Co. A supply of 300 miner's inches is available, but only one half of this will be required. J. F. Pixley is the vice president of the new company, and the secretary, J. W. Hyatt, is now at the mine.



Copper Region of Shasta County.

INYO COUNTY.

The Four Metals Co., operating a single smelting furnace at Keeler, has been producing $2500 of bullion per day. The slag pile of the old Cerro Gordo smelter is going to be put through this furnace, in addition to the ore from the old Union mine. An aerial tramway has been erected between the mine and smelter, and is being given a test run.

NEVADA COUNTY.

An ore-shoot discovered in the Prescott Hill mine maintains a good value with development. It occurs between the 500 and 600-ft. levels, is about 3 ft. wide, and averages $30 per ton. The same shoot is now being opened on the 700-ft. level, and a raise will be cut to follow it on the dip. On the 1200-ft. level drifts are being extended north and south. At the 1300-ft. station is an electric plunger pump, built in Grass Valley, which keeps the mine dry, working only eight hours per day. J. Brockington is superintendent.

The Posey Canyon gravel mine, three miles west of Grass

Valley, has made an unusually good weekly clean-up. The Posey company owns about 100 acres along the channel. An adit was driven 400 ft., when raises were put through into the gravel deposit. A drift is now to be run down the channel into the old Picayune workings. H. C. Zapf is president of the company.——The strike in the Sixteen-to-One mine, mentioned last week, turns out to be more excellent than described, for over $20,000 was taken out in two days. The pocket was first cut in the adit 225 ft. from the entrance and at a depth of 100 ft. from the surface. In driving 25 ft. E. H. Wilson and the other owners have not yet reached the farther limit.

SHASTA COUNTY.

(Special Correspondence).—The Mammoth Copper Mining Co. ships about 1200 tons per day from the Mammoth mine to the smelter at Kennett. This ore goes from the mine, over the electric tram, then down the gravity tram to bins, whence it is pulled by a steam locomotive to the smelter. The aerial tramway has been closed for the summer, and will only be used in case of emergency. The lack of storage bins between mine and smelter make it necessary for the operations at the two ends of the line to be closely in balance. All ore is drawn from chutes in the 300 tunnel, which is 2310 ft. above the furnaces at the smelter. Robert E. Hanley is superintendent of the mine.——A small force of men is at work on the Summit mine, owned by the Stauffer Chemical Co. of San Francisco. This company bonded the property from the Phoenix Securities Co. of New



Map of Northern California.

York, and about 18 months ago, during the period of financial depression, it bought the mine at a low price. This mine is 3 miles beyond the Mammoth and lies just to the west of Section 29. There are three main adits: No. 1, 150 ft. long, running north; No. 2, below No. 1, and running north 450 ft., with a drift west for 300 ft. and a winze down 175 ft. on an incline; No. 3, on the opposite side of the gulch, is 450 ft. long, but has been abandoned. Work at present is confined to driving a cross-cut north from the bottom of the winze in No. 2 tunnel. This is in 160 ft. There are some prominent shear-zones in the porphyry, the main one striking a little south of west, in which some good chalcopyrite ore is found. In the ground north of the shear-zone some ore has also been struck. No shipments have been made, and transportation from the mine is difficult. An electrically operated compressor furnishes air for one drill, a hoist, and a pump. Charles Kunze is superintendent.——No work has been done at the Golinsky mine since the Guggenheims gave up their bond, and the surface mule-tram that was built as an extension of the Holt & Gregg narrow-gauge electric road, is falling into disrepair. The Guggenheims confined their operations to stoping out all the ore exposed, and when this was done they abandoned the property without developing any more ore. The result is that the property is in bad shape to sell.

Redding, April 16.

The sulphide ore-bins and sampling plant at the Balaklala Consolidated Copper Co. collapsed on Monday, owing to a very heavy tonnage in the former. A portion of the tramway was also destroyed, as it terminates on the top of the bins; it is of the Riblet system, 16,130 ft. long, and its part-destruction will temporarily interfere with the production from the mine.

SIERRA COUNTY.

The new tramway at the Gray Eagle mine, erected by Walter M. Painter, is working admirably, and the 10-stamp mill is kept busy on good ore.——Lawrence Holley has driven an adit in the Chipps mine, and has been fortunate enough to find a vein within 30 ft. of the entry.——Oscar Anderson is now in Sierra City, and will make an examination of the Butte Saddle mine with a view to purchase.

TUOLUMNE COUNTY.

Machinery has been purchased for developing the Green-Jumper mine, situated near Confidence. During the early days many thousands of dollars were taken out at shallow depth, and present prospects are pronounced good.——The winze started a few weeks ago in the 400-ft. level of the Driesam mine, at Arastraville is 70 ft. deep. A large crew of men is employed at the property, and the mill is running day and night.——W. D. Deming will in a few days resume development work at the Big Four mine, formerly known as the Smith claim. The property, situated one half mile east of Tuolumne, has an adit about 300 ft. long which exposes several promising shoots of ore. The rock carries free gold and sulphides, and assays from a few dollars to over $500 per ton.——Several buildings are being erected at the Tarantula mine, including a residence for the mine foreman, change-room, and office. An air-compressor will be installed.——The adit at the McCormick & McPherson mines, near Jacksonville, is 600 ft. long, and work in it continues. The Huntington mill is running steadily, but an inadequate supply of water will cause its idleness during the dry season.

COLORADO.

OURAY COUNTY.

W. J. Cox, the manager of Camp Bird, reports that a raise from the new drift in the west end of the mine has struck ore of an average width of 3 ft. and assaying over $200 per ton. Sufficient work has not yet been done to find if it be an orebody of any magnitude.

IDAHO.

ELMORE COUNTY.

(Special Correspondence).—The Atlanta mining district, situated in the northeastern part of this county, was an important producer of silver in the early mining days. The rich orebodies occurred within a few hundred feet of the surface, and within the course of a few years were exhausted. Large bodies of low-grade gold and silver ore were known to exist, but could not then be treated at a profit. The camp is further handicapped by not having a railroad point nearer than Mountain Home, on the Oregon Short Line, 85 miles distant. Within the last year a wagon road has been completed from Boise to Atlanta. The road follows the Middle Boise river, has a good grade, and can be kept open during the entire year, as the winter just past has demonstrated.——The Pettit mine is owned by the Bagdad-Chase Mining Co., and employs 75 men. Wayne Darlington of Boise has been general manager. Practically all development has been confined to the Atlanta lode, of which the company owns 650 ft., together with several side claims. The mine is developed through cross-cut adits, and enough ore has been blocked out to keep the mill in operation for a number of years. The ore is conveyed to the mill by a gravity tramway 3500 ft. long. The mill contains 40 stamps and 2 tube-mills. About 40% of the value is extracted by amalgamation. Frue and Johnson vanners collect the concentrate, which is roasted in a reverberatory furnace previous to leaching with cyanide. The Atlanta Mines Co. owns the old Buffalo, Monarch, and Last Chance mines.

Practically all of the development work has been done in the Monarch. The shaft is down 600 ft., and the vein is opened several hundred feet on either side, exposing an immense tonnage of ore, in many places 30 ft. wide. A two-mile automatic tramway conveys the ore to the mill, which was designed by W. T. Sherman of Park City. Several months ago a trial run of two months was made in this mill, and the concentrating machinery found unsuited to the ore, so the mill was closed down. Daniel Kirby, the manager, has been to Pittsburg to consult with the owner, T. N. Barnsdale, and new concentrators will probably soon be ordered. Both the Bagdad and the Atlanta companies own electric power-plants on the Middle Boise river.

Atlanta, April 16.

IDAHO COUNTY.

The quarrel between Frank Peck and A. Adams, the owners of the South Fork mine, eight miles from Elk City, has been amicably settled without recourse to the courts. Work at both mine and mill will shortly be resumed.

SHOSHONE COUNTY.

(Special Correspondence).—A shipment of concentrate from the plant of the Mitchell Concentrating Co. will be made this week. The machinery is said to be working well and to be giving excellent returns. The plant is working the tailings in the Coeur d'Alene river, and is leased for two years to Thomas Cameron of this city.——The Pennsylvania & Coeur d'Alene Mining Co. has commenced suit against its president, certain of its officers, the State Bank of Murray, and others. It is claimed that during the years 1907 and 1908 the sum of $1300 each year was paid to the officers involved for the purpose of having the annual assessment work done, and that this money was appropriated by these men for their own use; and they then employed other of the defendants to re-locate the claims of the company. ——A scarcity of water for power purposes has forced a temporary close-down of the Reindeer mine at Mullan. The adit has been driven over 2500 ft., and it is expected that the vein will be cut within the next 300 ft.——The 531-ft. raise on the Tamarack & Chesapeak property has been completed. What the next step in development will be has not been made public, but it is believed that a large concentrator may be erected. The showing of ore in the property is said to be second to none in the district.—— At the delinquent sale of stock of the Hypotheek Mining & Milling Co. held in Wallace at the beginning of the week it was announced that all assessments had been met, and not a single share changed hands. This is almost a record in the Coeur d'Alene.

Wallace, April 17.

Leo Greenough, manager of the Snowstorm mine, says the company will pass the second dividend, due this month. No reason is given, except that the company is blocking out new orebodies, leaving the old unworked, until conditions in the copper market improve.——It is reported from Mullan that a strong flow of water has burst from the face of the west drift on the 400-ft. level of the National property, necessitating a shut-down. No more ground will be opened on the west side, the management fearing it will flood the mine. The pumps are taxed to capacity. A copper-galena vein 20 ft. wide was cross-cut a short time ago.

WASHINGTON COUNTY.

The directors of the Fidelity Copper Co. of Portland report the completion of a 400-ft. adit showing ore carrying 8% copper, $4 gold, $3 silver per ton for the entire length. They have placed orders for drilling machinery, and are preparing for heavy shipments when the railroad is completed from Huntington, which is promised in the early summer.

MICHIGAN.

At the Adventure all details have been worked out in connection with the proposed new shaft which will tap the three lodes disclosed by diamond-drill explorations last year. The work is expected to be in progress soon after the snow is melted. Operations will be under the direct supervision of the local management of the Quincy Mining Co.——The Michigan Copper Mining Co. is opening rich ground in the so-called Bee workings, east of the Michigan mine proper. The lode has been opened for a distance of 100 ft. on the adit level, and shows uniform good grade of stamp 'rock'. The new discovery is 60 ft. west of and parallel to the Calico lode, from which a cross-cut is being driven to join them on the 800-ft. level.——The new vein on the 17th level of the Mass Consolidated mine shows 7 ft. of good copper-bearing amygdaloid, and several feet with abundance of the associated mineral epidote. The superintendent, James W. Wilcox, has opened the lode 41 ft., and a diamond-drill has cut the same lode 100 ft. lower down.——The New Baltic Co. expects to have two diamond-drills in operation shortly. Trenching has temporarily ceased, owing to spring freshets and the attendant difficulties in keeping the surface workings free of water.

The annual report of the Franklin Mining Co. shows that there was a deficit of $28,000 at the end of the year. Practically all the work at the mine has been done at reduced costs. The total openings in 1908 aggregated 4305 ft.; the amount of copper per ton of 'rock' stamped was 10.82 lb., and the total cost per ton stamped was $1.57. It is the intention of the Franklin management to assume control of the Rhode Island Co. in June, after which time the north drifts from the Franklin No. 1 shaft may be continued into Rhode Island property and open up what is believed to be valuable ground at very little expense. R. M. Edwards is superintendent.



Mass Copper in Michigan.

MISSOURI.

JASPER COUNTY.

One of the best recent galena strikes was made on the old Log Cabin lease at Duenweg, where at a depth of 80 ft. rich ore was found. This tract has been a good producer for a number of years, and the new strike is not inferior to the former deposits. Its extent has not yet been determined.——The Pinnacle mill, which was recently completed in the Oronogo camp, is now producing. One shaft shows a face of ore 10 to 14 ft. high, carrying both galena and blende. Another shaft is being sunk for better ventilation. The company is now producing from 6 to 8 tons of zinc-blende per day, and about two tons of galena.——The Weaver Tri-City mill on the lease northwest of Carthage is now complete and ready for work. It is designed to treat 150 tons per day. This land was thoroughly prospected a year ago, and the ore developed to 200 ft. The shaft was later sunk, but various obstacles have caused delay in starting.——The Swayback mill No. 1 has been purchased by the Nowata Lead & Zinc Co., which will remove it to the new lease in Porto Rico. The lease comprises the Ruby tract, where fully 500 ft. of driving has been done. The ore there has hitherto been cleaned on hand jigs.——A new mill, the Regina No. 2, is being built in the North Webb City sheet-ground camp on the Guinn land. Some of the machinery is installed, and the plant will soon be ready for operation.

Two other mills are to be erected in this camp, one already being started, in which a new type of machinery will be used, which will decrease the cost of construction.

MONTANA.

MISSOULA COUNTY.

The Copper Hill Mining Co. is developing 12 claims on Sunrise gulch near Quartz. The vein running through the group, as shown on the croppings, is from 25 to 50 ft. wide and runs about 4% copper. The company has driven 75 ft. of an adit to cut the vein at a depth of 200 feet.

NEVADA.

ESMERALDA COUNTY.

The recent reduction by the railways in ore-hauling rates has proved a boon to the miners of this district, enabling them to have smelted at a profit ore which under the old rates could not have been shipped with sufficient profit. It is believed that while the railroads are not making so great a margin of profit on shipments as before, the volume has so increased that the aggregate net profit has shown a gain. Hopes are now expressed that further reductions may be brought about by the various officials of the railroads now in Goldfield.——An important strike of galena has been made on the Christensen lease of the Lucky Boy mine, at Hawthorne. The mine in general is doing very well and is shipping a carload of lead ore every day.——Systematic development is being carried forward in the Little Florence lease on the Combination Fraction, which has resulted in opening a large amount of low-grade ore, but no extensive body of shipping ore. The manager, George Vickers, says that the reports that a large amount of high-grade material had been found were without foundation. The new electric hoist and air-compressor that were installed a few weeks ago have greatly aided development.——Preparations are being made to install a 75-hp. hoist on the Grizzly Bear, which will be sufficient to sink the shaft to 1000 ft. The shaft is now down about 400 ft., having two compartments. No vein has yet been cut. The work is in charge of Bruce K. Jones.

LINCOLN COUNTY.

The Prince Consolidated Co., at Pioche, is working nearly 50 men; the Golden Prince, Gold & Silver Prince, and Pioche King making up another fifty. Dean S. Low, one of the principal owners of the Golden Prince and the Gold & Silver Prince, is erecting a fine residence near the mines. A 25-hp. Alamo gasoline hoist is to be installed at the latter mine, and other improvements include an electric light and refrigerating plant, a new boarding house, and an assay-office. Thomas Varden is mine superintendent.——E. F. Freudenthal is developing the Colfax property, in the Highland district of Pioche, with success. He finds that the shaft continues in silver ore as it progresses.——The Boston and Pioche mines have a good new orebody on the 600-ft. level, that is not less than 12 ft. thick.

NYE COUNTY.

(Special Correspondence).—Owing to the number of rich strikes recently made on its estate, the Queen Bethania Mines Co. has decided to dispense with future leases and will work the ground on company account.——At the Murray lease on Consolidated ground good ore is being broken and treated at the Murray mill. The shaft is going down in good ore.——New York engineers have been in camp during the last few days on behalf of Eastern financial interests. It is reported that they are desirous of securing control of the Rawhide Coalition and Queen properties. If the deal is made it is planned to sink three shafts on the Coalition, erect a 500-ton mill at Walker lake, and complete the Rawhide Western railway.——The construction of the Evans mill on Gold Dick hill is progressing rapidly. The first two batteries of stamps will be soon placed.——Milling conditions in this district are constantly improving and the cost is being gradually reduced. Many stamps are now crushing five tons of ore per day, and it is expected to do better in the near future.——Placer mining at Manhattan continues to excite the district. Dozens of shafts are being sunk in the gulch and a number of claims have been located. The pay gravel is said to run from 14 to 70 ft. deep. Water is plentiful on several claims. Several small nuggets, in addition to free gold, have been found.

Rawhide, April 17.

The total output of the Tonopah mines last week was 5400 tons, of which the Tonopah Mining Co. produced 3100. Both mine and mill of this company have operated steadily without any unusual occurrences.——At the Belmont, development at the bottom of the mine, on the 1100-ft. level, continues excellent, and in the 1054-ft. winze another vein of high-grade ore has been cut, worth over $200 per ton.——A break-down in the return-water pump at the Montana Tonopah mill prevented more than an average of 25 out of the 40 stamps dropping for four days.——Good progress is being made in the construction of the new power line of the Nevada California Power Co. which is being built between Millers, Manhattan, and Round Mountain. If no unnecessary delay occurs, the wires should be strung to Manhattan early in May.——Eighty-four tons of ore were sent out from the Pioneer, near Rhyolite, one day, and 100 tons another day. In a month it is hoped to improve this to 200 tons per day. A compressor and 5 drills have been started and 3 more drills have been ordered. The best ore is coming from the bottom level.——The Beatty custom mill will be ready for operation some time next month, as nearly everything is installed except the power. It contains 10 stamps and supplementary equipment, and arrangements have been made for maintaining a continuous supply of ore.

WHITE PINE COUNTY.

The Steptoe Smelting & Mining Co., which concentrates and smelts the ores of the Nevada Consolidated and Cumberland-Ely mines, is receiving approximately 4000 tons per day at the Steptoe mills, three units of which are in operation. Unit No. 1 treats 1500 tons per day of Cumberland-Ely ore, which is largely a sulphide running 3% copper; units No. 2 and 3 operate on Nevada Consolidated ore, also a sulphide, running about 2.3% copper, the daily tonnage being about 2400 tons. Cumberland-Ely ore is concentrated in the ratio of four into one, the Nevada Consolidated ore about nine to one. Unit No. 4, to have the same capacity as the others, is being constructed and machinery being installed. It is expected to be ready for operation next July, and will be run on Nevada Consolidated ore.——At the Steptoe smelter three reverberatory furnaces, each 111 ft. 10 in. long, with 6 by 10-ft. fire-boxes, are in operation, each furnace handling about 300 tons per day of concentrate after same has undergone roasting in the MacDougall roasters. The furnace product, a 45% copper matte, is passed to the converters, of which there are three stands. The plant has been producing 3,750,000 lb. of copper per month, but this production is increasing. The blast-furnace equipment is partly in place, but not completely installed. The fourth reverberatory furnace is being built, and it is stated that it will be ready as soon as unit No. 4 of the mill shall be finished. It is observed that the slag tapped off from the reverberatories is granulated and carried away in the mill-tailing. S. S. Sorensen is chief engineer and superintendent of the smelter, G. F. Waddell is mill superintendent, J. D. Watson being mechanical engineer for mill construction. C. B. Lakenan is general manager for all mining, milling, and smelting operations.

NEW MEXICO.

SOCORRO COUNTY.

The Chemung property, in the Burro Mountain district, is developed to the 500-ft. level, and an orebody has recently been followed for 45 ft. on that level, averaging 3½% copper.——Officers of the Pan American Federal Smelting & Refining Co., which has undertaken the work of rehabilitating the old Billings smelter at Socorro, report that a bond issue of $100,000 has been disposed of. Included in the trade for the smelter is a tract of land amounting to 183 acres, and a pipe-line 1½ mile long which will supply water to the plant.

UTAH.

BEAVER COUNTY.

The Kincora Mining & Milling Co., which was recently incorporated, is the owner of a group of eight claims in the Beaver Lake mining district. This property adjoins the Newhouse Copper Mountain property. The development work thus far has consisted of an adit about 200 ft. long, and is to be advanced. The mine is 6 miles from the railroad, and 13 miles from the town of Milford.

SALT LAKE COUNTY.

With the commissioning of the tenth section of the Boston Consolidated milling plant, near Garfield, and the increase of shipments from the porphyry deposits, this mine will take rank as the second largest copper producer in Utah for the remainder of this month. These 10 sections can be counted on to treat 2250 tons per day, and there are three more to bring into operation before long.——Samuel H. Treloar has sunk the shaft of the Bingham Butte mine into a body of rich copper ore at a depth of 180 ft. below the main adit level. He declines to give the assays till he has sunk enough to be able to state its average value.

SUMMIT COUNTY.

The mill of the Silver King Coalition is treating 450 tons per day. Crushers, rolls, and Huntington mills do the crushing and grinding; the concentrating is on Hartz jigs, Wilfley tables, Frue vanners, and Wilfley slimers. Revolving screens do the classifying ahead of the jigs, and Callow traveling screens ahead of the tables. The undersize from the 30-mesh Callow screens is settled and de-watered in a V-shaped gravity settler. The vanners operate on a finer mesh material than do the tables; and the slimers handle the overflow from the spitzkasten and the underflow from the settling-cones. They are not now using the filter presses for collecting the flocculent slime as formerly. J. W. Thompson, mill superintendent, has put into use a sampling device of his own, which works admirably.

WASHINGTON.

FERRY COUNTY.

The smelter returns from five carloads of ore shipped from the Republic mine by the New Republic Co. show the average value to be $70.50 per ton, the contents being in the ratio of 4½ oz. silver to 1 oz. gold.——The Spokane Falls & Northern Railway Co. is clearing the roadbed of debris on the spur to the No. 3 adit, to facilitate shipments. The mine has been cleaned up, from the surface down to the 600-ft. level, and is now in excellent shape for mining. ——At the San Poil mine four men are working under lease and shipping two carloads of ore per week, averaging about $20 per ton. An order has been placed for a Fairbanks-Morse 3-drill air-compressor, to be electrically driven by power to be supplied by the New Republic Co. The ore produced comes from the upper levels.

OKANOGAN COUNTY.

A small force is now employed in the Palmer Mountain Tunnel & Power Co.'s main adit, now in about 4500 ft. The manager at the mine says that probably only development work will be done this season. The mine is situated near Loomis, 12 miles south of the International boundary line. Twenty-eight veins, of varying width, are said to have been intersected in the course of this adit, and about 3600 ft. of laterals and raises have been made on the various veins. About 1200 ft. west of the mouth of the main adit is a 100-stamp mill, built by the Traylor Engineering Co., equipped with 20 Garvin cyanide machines.——A shaft on the Olentangy mine has been sunk to a depth of 142 ft. and has found ore, none of which assays less than $18. Cross-cutting will be started when the 150-ft. point is reached. There is a 30-hp. gasoline hoist and an Ingersoll-Rand compressor at the mine. John H. Arnold, president of the company, is now at the mine.

CANADA.

BRITISH COLUMBIA.

The Greenwood-Phoenix Tramway Co., of Chicago, has started preliminary work on the 3-mile tunnel to join the towns of Greenwood and Phoenix. Local taxpayers have voted $50,000 to the company, and the remainder of the necessary money has been subscribed in New York and Chicago. Compressors and electric drills are being installed at the Greenwood end of the tunnel, and it is given out that construction work will begin in a short time. As the undertaking does not involve any unusual engineering difficulties, it is believed that rapid progress will be made from the start. The tunnel in the course of its advance will cut numerous veins, believed to be 18 in number, in the first 6000 ft. The first will belong to the Strathmore mine, after which follow the Defiance, Yellowstone, Idola, Don Pedro, and Crescent.——A. B. W. Hodges, general manager of the Granby smelter, is taking the opportunity of the low price of copper to remodel the furnaces, two at a time. The first pair have already been enlarged, and on a trial run treated 530 tons each.——Paul S. Cauldrey, manager of the Le Roi No. 2, is shortly to retire from the management of that mine.

YUKON TERRITORY.

Arnold F. George, the secretary of the Miners' & Merchants' Association of Dawson, has made a detailed report of the placers of the region for the Mining Commission of the Yukon. It thoroughly covers the operations conducted on Forty-Mile and Sixty-Mile creeks, besides those in the district known as the Upper Stewart.——The dredge intended some day for the Miller creek concession, owned by the N. A. T. & T. Co., will not be ordered till the fall. It has been found by trial that when the gravel is cleared of 'muck' and is allowed to remain three or four years untouched, the thawing process continues alone until the entire gravel deposit is softened. This method does away with the expense of thawing by steam-points. It is probable that the dredge to be ordered will have 3-cu. ft. buckets, or much smaller than those now in use on Bonanza and Hunker creeks. In places Miller creek is not more than 75 ft. wide, with rather steep hillsides adjoining. The 'muck' will be moved this summer by water under pressure, and it is expected to sluice off enough to open about 200,000 yards for thawing. Guy A. R. Lewington is the engineer in charge, and 15 men will be employed.——The Pueblo, owned by Byron White of Spokane, is not shipping any ore, on account of the low price of copper and the heavy transportation charges. This property is looked upon as being the most promising in the district, there being an immense body of ore which is said to run 3½% copper, in addition to gold and silver.——The Arctic Chief has also been closed down since last fall, on account of the prevailing conditions. The ore of this property is rated at 8% copper. It is claimed that this mine possesses about 250,000 tons of probable ore. Capt. John Irwin of Victoria, B. C., is the owner.

MEXICO.

BAJA CALIFORNIA.

The second largest producer of copper in Mexico is the Compagnie du Boleo, operating near Santa Rosalia. This property is controlled by the French house of Rothschild, and all the copper is shipped direct to France. Consequently little is heard as to this company's operations. In 1907 the copper production was 24,530,000 lb. When the Greene-Cananea property shut down, this company secured 2000 of the Greene laborers, as a result of which its operations were materially increased, and its production for 1908 is believed to have been in excess of 30,000,000 lb. Until December 1912 the company enjoys special exemptions from Federal and local taxation, granted by the Mexican Government. Ernest Michot is manager.

CHIHUAHUA.

Connections have now been made between the adit and main shaft of the Palmilla mine. The adit is 343 m. long, and will save a lift of 133 m. in pumping. Sinking is being continued in the main shaft.——Geo. V. B. Levings has been appointed manager of the El Rayo Mining & Development Co. He succeeds Bert Peterson, who died in California in February. Levings was formerly assistant manager of the property.

Special Correspondence.

TORONTO, CANADA.

Cobalt Lake Decision. — Shipments. — Crown Reserve Report.— Chambers-Ferland.—Nipissing.—Gowganda.

The Cobalt Lake case, which has figured so extensively both in the courts and the legislature, and had become an important political issue, is at length settled by the judgment of the Court of Appeal. The noteworthy feature of the case was the interference of the Ontario Government with the ordinary routine of the courts by the passing of a special act guaranteeing the title of the Cobalt Lake Mining Co. to the property in dispute, namely, the bed of Cobalt lake, and declaring the claim unimpeachable, although an action was at the time pending by the Florence Mining Co. on the ground of previous discovery. This measure aroused a good deal of controversy, quite apart from the merits of the case, and was condemned by many as a dangerous precedent and an unwarranted attack upon vested rights. It was claimed that the act was *ultra vires*, and an attempt was made to invalidate it, but both the Canadian Government and the courts pronounced that it was within the prerogative of the Legislature, and therefore could not be upset merely on the ground that it was bad legislation. The Court of Appeal, while upholding the act as giving an indefeasible title to the Cobalt Lake Co., went into the merits of the Florence Mining Co.'s claim, and decided that, even apart from the validating act, the case of the plaintiff, based on an alleged prior discovery by W. J. Green, had not been made out; that Cobalt Lake was closed to prospectors at the time the discovery was made, and that although a contrary inference might have been drawn by Green from the maps and literature supplied to him by the Government, a simple question put by him to any of the officials would have set him right. This ends the matter, so far as this particular dispute is concerned, but it does not by any means remove the bad impression left in the minds of investors by the action of the Government.

Shipments of ore from Cobalt continue heavy. March was a good month, the output amounting to 2561 tons, as compared with 2103 tons in February, and 2375 in January. The total shipments for the quarter, 7040 tons, were twice the amount of shipments for the corresponding months of 1908, which only totaled 3481 tons. Dividends paid by the principal mines have also been heavy. The Crown Reserve has issued a financial statement covering the first three months of the year, showing ore shipped having a total net value of $452,405. Operating expenses amounted to $45,779; the amount spent on plant was $10,949, and royalty paid the Government was $40,168. Dividends of $256,322 were paid, leaving a surplus of $90,185, making a total surplus at the end of March of $437,302. It is officially stated that at a depth of 75 ft. in the west winze below the 100-ft. level the vein has strengthened and is yielding rich ore. A winze is being sunk at the east end of the vein that will block out ore on three sides. The Foster has continued development from additional funds secured from New York. The advance is to be protected by a percentage interest in the output. The Kerr Lake has declared the regular quarterly dividend of 4%, in addition to a bonus of 2% payable June 15. The Coniagas has declared the regular quarterly dividend of 3%, payable on May 1. At the Chambers-Ferland water has considerably retarded work in No. 1 shaft, making it necessary to install an extra pump. Driving at the 150-ft. level has been done north and south for about 80 ft., the vein averaging 3 in. and carrying about 5000 oz. silver per ton. The engine house of the Beaver was burned April 5, but the mine was only idle for a few hours, as arrangements were made with the Temiskaming for a supply of power. The north half of the Bailey property has for some time been under lease to the Cobalt Central. The lease was cancelled April 1 and the Bailey is arranging to install its own plant and will do diamond-drilling. The annual report of the Nipissing will shortly be distributed to about 12,000 shareholders, as against 14,600 one year ago, some of the larger interests having absorbed much of the stock. The ore reserves are estimated at $2,500,000 gross. It is claimed this estimate is based on more conservative methods than have hitherto been followed. During March ore of an estimated value of $141,623 was mined, and shipments made of the value of $193,845. Recent important developments include the striking of ore on the 175-ft. level of vein 64; the cutting of veins 89 and 67 from the 60-ft. level at the Kendall; and the increased showing of ore in vein No. 26 below the 110-ft. level. E. W. Beidler, superintendent of the Alexander, is arranging for the installation of a diamond-drill in the bottom of the main shaft, which is now down 170 ft. A vein found at the depth of 160 ft., where it was a narrow stringer, has widened at the 170-ft. level, and shows good silver content. A new calcite vein 6 in. wide has been discovered on the surface. A small 3-drill compressor has been installed on the Silver Cross property and driving is being done on the veins upon which the two shafts were put down.

Owing to the breaking up of the winter roads, Gowganda is now practically inaccessible, except by walking, though at last accounts a few teams were carrying light freight at enormous rates. There is consequently a lull in Gowganda flotations. So many of these have been made, at a time when the investing public was disposed to be shy, that Gowganda bids fair to be a disappointment. Few of the companies will be able to secure adequate capital for development. Over-capitalization has been carried to an absurd extent, and this, taken in connection with transportation deficiencies and the consequent enormous expenses of installation of machinery and shipment of ore, casts a doubt on the realization of dividends. Gowganda is much more likely to repeat the history of Larder Lake than of Cobalt. Until the transportation is properly organized at least, investors should be cautious.

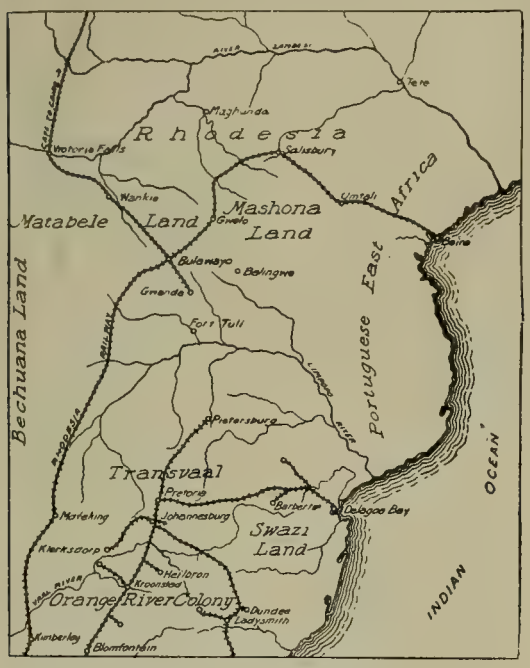
LONDON.

Globe & Phoenix, Rhodesia.—Victoria Falls Power Co.—Rand Power Contracts.—Vereeniging Station.

Perhaps the most successful gold mine in Rhodesia is the Globe & Phoenix, at Que Que, or rather, the Phoenix, for the Globe itself is now shut down. Though the workings are at considerable depths, the cost of operation are gradually being reduced, and the grade of ore developed is improving. Good extraction is made, in spite of the fact that antimony is present. During 1908 the mill treated 75,413 tons, yielding 36,740 oz., or 8.05 dwt. per ton, over the plates, and losing 3.95 dwt. in the tailing. Further treatment consists of cyaniding the sand and slime. The sand treated was 51,704 tons, and the yield was 4036 oz., or 1.78 dwt. per ton. This cyanide treatment gives a low extraction, but even then the product was half profit. The slime plant is not so successful in handling slime now made, extracting not much more than one third of the gold content. On the other hand, accumulated slime works better, the yield being 80%. The total value of the gold won during the year from all sources was £154,555, and the profit, after making full allowance for mine development and depreciation, was £39,511. The year commenced with a balance in hand of £48,000, and £40,000 has been distributed as dividend. This is at the rate of 20% on the capital of £200,000, leaving £47,000 to be carried forward. The company has therefore plenty of available funds; in fact, besides the balance it has a reserve fund of £33,600 invested in good securities. As regards ore-reserves, the figures of December 31 last stood at 144,348 tons of an estimated content of 16 dwt. This is a notable increase within the year, both in quantity and content. In the current year not quite so much development can be done, for the depth of the workings has rendered it imperative that attention should be devoted instead to the provision of additional hoisting plant. During the year a sorting and jigging plant has been provided, for the better elimination of the antimony. As regards costs, they amount to £1 2s. 0d. per ton, as compared with £1 4s. 0d. a year before. In addition, 4s. is charged for mine development,

bringing up the total costs to £1 6s. 0d. per ton in 1908, and £1 8s. 0d. per ton in 1907. The total costs were £99,964, but London expenses, depreciation, and income tax add a further £17,400, or 4s. 6d. per ton.

The application of electric power to mining on the Rand is progressing rapidly. The Victoria Falls Power Co. was formed two years ago to utilize the water-power of the Victoria Falls on the Zambesi river. It was originally planned to generate electricity on the spot and bring it to Johannesburg. Subsequently it was found that there was difficulty in getting right-of-way for the lines, and the Transvaal Government did not care to grant the right of condemnation. It was found also that the cost of installation and transmission would probably be greater than that of a local steam-plant. There were also complications arising out of a rival scheme for generating current at Vereeniging, on the Orange River Colony border, where the local coal resources could be used. Eventually local steam-power stations were decided upon, and as a start the generating stations of the Rand Central Electric Works were purchased. The company, finding that the line to Victoria Falls would have to wait, altered its name to the Victoria Falls & Transvaal



Map of the African Goldfields.

Power Co. In addition to the Rand Central works, the company owns generating stations at Brakpan and Simmer Pan, and it supplies a number of mines with electric power. Recently a contract was secured to supply power to mines belonging to the Rand Mines and the Eckstein group, and it became necessary to issue new capital to provide funds for the extension of the generating plant. The present issued capital of the Victoria Falls company is 1,000,000 ordinary shares of £1 each, 800,000 preference shares of similar denomination, and £800,000 of debentures. The additional capital now being provided amounts to £900,000 in preference shares and £900,000 of debentures, and as the issue has been underwritten, the scheme will proceed without delay. The new contract with the Rand Mines group will be cared for by a specially formed subsidiary company, the whole of the capital of which will be subscribed by the Victoria Falls company out of the money raised from the present issue. The mines to be supplied by this contract include the following Deeps: Glen, Rose, Geldenhuis, Jumpers, Village, Ferreira, Robinson Central, Crown, Langlaagte, and City, together with Nourse Mines, Village Main Reef, Robinson Gold Mining Co., Bantjes Consolidated, and New Modderfontein. At first the amount of current taken will be 130 million Board of Trade Units per year, which is approximately 15,000 hp., and within a few years the amount will be doubled. Another important contract is with the Consolidated Goldfields, which has contracted to take power for the Simmer & Jack, Simmer & Jack East, Simmer Deep, Knights Deep, Jupiter, and Robinson Deep. These will take 40 million units. The Barnato group will take 33 million units for the Consolidated Langlaagte and the Van Ryn Deep, and similar contracts are made with the Albu and Goerz groups, besides other mines, such as Jumpers, Brakpan, Witwatersrand Deep, and Knights Central. Within three years the total output will be about 400 million units. The company has also made an agreement to establish a generating station of 30,000 hp. at Vereeniging, provided the Government will allow the transmission poles to be erected across country. Other contracts provide for the acquisition of interests in local collieries. These facts show the extent of the company's operations. Without doubt the electric power supplied will further reduce the costs on the Rand and make it possible for low-grade ores to be worked which otherwise would have to remain untouched.

JOHANNESBURG, TRANSVAAL.

Modern Deep Level Mining. — Some Daring Proposals. — A Single Shaft.—Amalgamation Process Eliminated. — Stamps, Chilean, and Tube-Mills.—Scheme of Administration.

One of the most daring papers read at a meeting of a Rand technical society for many years was delivered by H. H. Johnson, manager, and H. F. Roche, mine captain, of the Village Deep, Ltd., before the South African Assoc. of Eng. on March 6. The magnitude of the subject, namely, the surface equipment of deep-level mines, recalls H. S. Denny's paper on the 'Metallurgical Practice of the Witwatersrand' read in 1903. Just as that contribution to technical literature evoked a vigorous discussion and stimulated research in certain directions to the lasting benefit of the industry, so will Mr. Johnson's paper form a basis of keen and useful controversy. The suggestions are, admittedly, not all original, but the authors have introduced with their own a number of parentless ideas. The paper touches upon many salient problems of modern mine equipment. The authors start by assuming the case of a representative deep-level mine of the future "This will be upward of 1500 claims of 60,000 sq. ft., containing, we will assume, 50,000 milling tons per claim." This assumption of 50,000 milling tons per claim is probably too optimistic for a representative Rand deep-level mine, especially of the East Rand—the great deep-level district of the future. The great claim-area is assumed in order that working costs per ton may be brought to 'the irreducible minimum' by large scale milling, and to provide for a life of a length sufficient to make unnecessary for many years the setting aside of profits for the redemption of capital. The property assumed would contain 75,000,000 milling tons, and for this a plant would be erected to treat 150,000 tons per month, or 5000 tons per diem, to "obtain a life of not less than 45 years." Mr. Kotrjé, the Government Mining Engineer, commented that such a length of life could scarcely be considered the most profitable, and suggested that it would be better to deal with the ground in areas smaller than 1500 claims. On the other hand, the idea of an 'indefinite' life—say, half a century—has gained great popularity in financial circles, as witnessed in the case of the recent Crown Mines amalgamation. To supply 5000 milling tons per day, after allowing for 18% sorting, it would be necessary to hoist about 7000 tons per day, excluding Sundays. The authors propose one deep-level vertical shaft of nine compartments, 58 by 9 ft. outside timbers, giving four compartments for rock, four for men, stores, and material, and one for pipes, cables, and ladders. They assume that "connection will be made with the properties nearer the outcrop, even if payment has to be made." Although this provides for ventilation and safety, it is doubtful if such a scheme of extreme centralization—in a mine presumably about 1½ miles across—will be generally favored. The authors have promised a companion paper

discussing the underground conditions. Comment on this point may be deferred, therefore, until the systems of underground traction and plan of inclines are described. The vertical depth of the shaft would be about 4000 ft. Electric hoists would be used, with cylindro-conical drums arranged for hoisting at a maximum speed of 4000 ft. per minute, with 7-ton skips. Allowing for stoppages, inspections, and other delays, it is assumed that the two hoists will handle 7000 tons per day. The principal features of the arrangements proposed at the shaft-head are large ground-level storage bins (1000-ton capacity), divided into compartments for fine and coarse rock, and long grizzlies with mechanically operated moving bars instead of trommels. The ore would be conveyed to the crusher in 2-ton, side-tipping, cars, discharging the coarse into concrete chutes having sprays to clean the rock prior to sorting. Picking belts 36 in. wide are designed to run from the bottom of the chutes. From the belts the ore would go through coarse crushers to fine sorting belts, following which fine Blake crushers are proposed.

The part of the authors' paper which deals with ore-reduction and gold-recovery appears, in the light of Rand practice to date, to be the most hazardous and original. Put as briefly as possible, their proposals are as follows: The mill is to consist of 260 stamps of 1250-lb. weight and, as in the new Simmer Deep plant, timber will be used for only the king-posts, guide-blocks, and platforms. Mortar-box foundations will be of concrete, without anvil blocks. This latter provision is of interest, seeing that the Village Deep, with which the writers are associated, was one of the first to adopt anvil blocks. The implied condemnation is not supported by arguments. The mill-bins, of 12,500-ton capacity, would be constructed of reinforced concrete. The superstructure will carry the shuttle-belt upon which the crushed ore and fine will be delivered by conveyor belts. In the treatment of the ore, amalgamation would be eliminated altogether. This idea is not advanced with any claim to originality. It has, indeed, been in the minds of local engineers for some time. The move made by the Eckstein Central administration has already been noticed. Experiments on a working scale will shortly be undertaken. The scheme proposed by Johnson and Roche, however, is far in advance of anything yet publicly suggested, and involves radical changes which few directors would care to finance without gradual demonstration. Immediately in front of each mortar-box, they suggest cone-classifiers set on separate foundations, to extract the bulk of the minus-200 mesh sand, the underflow going to improved Chilean mills. "Each five stamps will then crush 100 tons per day through ¾-in. mesh, giving a stamp-duty of 20 tons per 24 hours; 20% of this product will pass a 6-mesh screen in addition to the 20% which will pass a 30-mesh, making 40%" which will not require to be re-ground in the Chilean mills. Such a definite pronouncement as to resultant conditions when using stamps for this unnatural class of work does not appear to be warranted by the lessons of past experimenting on such novel lines. The subsequent deductions, however, follow if the premises be accepted. The coarse product from ten stamps would go direct to one Chilean mill of 120-ton capacity discharging through 300-mesh. The pulp therefrom would be elevated by tailing pumps to de-waterers and cone-classifiers, all the slime being here eliminated and the coarse sand delivered to a battery of 20 tube-mills (5 ft. 6 in. by 20 ft. long). Tube-mill pulp would be returned to the general flow from stamps for re-elevation to the classifiers. The clean sand from the classifiers would be discharged to drying tables of the Caldecott type (lately introduced at the Simmer & Jack and Simmer Deep mills), which in turn would deliver into a launder in which cyanide solution would carry the sand through pumps to the sand-treatment vats. The sand-plant will comprise 25 treatment vats of 1000-ton capacity, fitted with Butters & Mein's distributors, and the slime-plant of 8 settling and 16 treatment vats, 80 ft. diam. This is 10 ft. larger than the greatest in use at present on the Rand.

Quoting the experience of the Homestake mine, the authors propose the use of zinc-dust for precipitation. They include in their paper a scheme of administration, not entirely new, and which will probably be adopted even though milling and cyaniding methods remain practically unchanged. The general policy will be laid down initially by the consulting engineer in conjunction with the board of directors. The general manager will reside at the mine and be responsible for the direction of work, being aided by an assistant manager. The engineer will be responsible for the whole of the underground and surface hauling, the sorting, crushing, and the milling as far as the Chilean mills or, in ordinary practice, as far as the stamps. A chief metallurgist will be in charge of all gold recovery operations, assisted by the necessary foremen in each branch of work. Many portions of the paper will meet with general approval, but the authors must be prepared for criticism of their system of dealing with so great an area through one vertical shaft and of using stamps to perform the functions of fine crushers or of rolls, for the feeding of Chilean mills.

The sixth ordinary general meeting of the Premier Diamond Mining Co. was held on February 23, and was noteworthy for the mass of useful information provided to shareholders and for the bold, uncompromising attitude adopted by the managing director in his criticism of De Beers. Ross Frames did not mince matters by elaborate explanations of the change in the relationship between the Premier company, De Beers, and the London Diamond syndicate, but plunged bravely into an attack upon the Kimberley corporation, accusing it plainly of having caused the fall in the diamond market by its over-production, and also of exaggerating the significance of the collapse in order to impress upon the Transvaal concern the advisability of curtailing its yield. The chairman, Mr. Cullinan, read the report of the company's London agent, announcing an improvement in the market and a satisfactory outlook. In spite of these assurances, it is impossible to regard with composure the Board's firmly expressed determination to continue the expansion of work at the mine. Last year, the Premier turned out 2,078,825 carats of diamonds. The mine appears to have arrived at a permanent grade of 25 to 26 carats per 100 loads. When the new treatment plant is in full swing, 50,000 loads (16 cu. ft.) per day will be treated, or roughly 16,000,000 loads per annum, for a yield of 4,000,000 carats. Owing to the increased scale of work and higher efficiency, working costs will stand at 1s. 6d. per load, so that the cost per carat will be about 6s. From the purely technical point of view, the records reflect the highest credit upon the company's management, but the craving for low costs obtained by working enormous quantities of ground cannot fail to lead to financial difficulties in the commercial departments. A monopoly in diamonds ceases to exist, and we must look to South Africa's proverbial good luck to relieve the disquieting situation established by two rival concerns of unlimited resources—one curtailing operations to suit the times, and the other boldly duplicating its capacity —which are supplying a sensitive and weakly convalescent market through competitive channels.

NEW YORK.

International Smelting.—Bonanza Copper.—Tennessee Company.—Inspiration Copper Co.—Rawhide Coalition.—Curb Rules.

Stock in the International Smelting & Refining Co. was over-subscribed, and the first allotment of $10,000,000 has been made. The stock was issued at par of $100 per share. The first quotations on the New York Curb are $130 bid and $140 asked. The board of directors includes John D. Ryan president, Dennis Sheedy vice-president, J. D. Allen treasurer and secretary, and Urban H. Broughton, Chas. F. Brooker, Thomas Cole, Adolph Lewisohn, E. C. Converse, Thomas Morrison, C. A. Congdon, Chas. F. King, J. W. Allen, and William D. Thornton are directors. The company will not confine its operations to copper mining, smelting, and refining, but will deal in metals, mines, and in mining and metal stocks. Options have been taken on controlling

interests in the Allis-Chalmers Co., the American Brass Co., the International Nickel Co., and other metal companies. It is believed that the company will later extend its operations to lead, zinc, and aluminum. It will also operate extensively in stocks in Wall Street.

It is announced that J. P. Morgan & Co. have completed arrangements for the purchase, from Norman Schults and the Havemeyer estate, of the Bonanza Copper Mines, Alaska. These were formerly known as the Kennicott mines, and are situated about 180 miles northeast of Valdez.

The directors of the Cerro de Pasco Copper Co., Peru, have instructed the manager to keep up production to the full capacity of the smelter. The output at present is about 4,000,000 lb. monthly. In response to the numerous protests of the shareholders, Walter Lewisohn, president of the Tennessee Copper Co., states that it is possible that a dividend will be declared shortly. At the recent meeting the directors considered it advisable to take no action in regard to a dividend, owing to the poor condition of the copper market and the uncertainty surrounding the company's negotiations for the sale of its output of sulphuric acid. As the fertilizer manufacturers concerned have already paid a deposit of $500,000, it is most probable that the deal will go through. The Tennessee Copper Co. will then have a steady purchaser for all the acid its $1,000,000 plant is able to produce. The Inspiration Copper Co. has been formed, with a capital of $10,000,000, divided into 100,000 shares of preferred stock and 900,000 shares of common stock, to develop some copper claims adjoining the Miami Copper Co.'s claims at Globe, Arizona. The stock has been underwritten, and is quoted on the New York and Boston Curbs and on the Kansas City and Salt Lake Mining Exchanges. The company's property comprises an area of 400 acres, and is reported to contain a large copper deposit assaying about 2% copper.

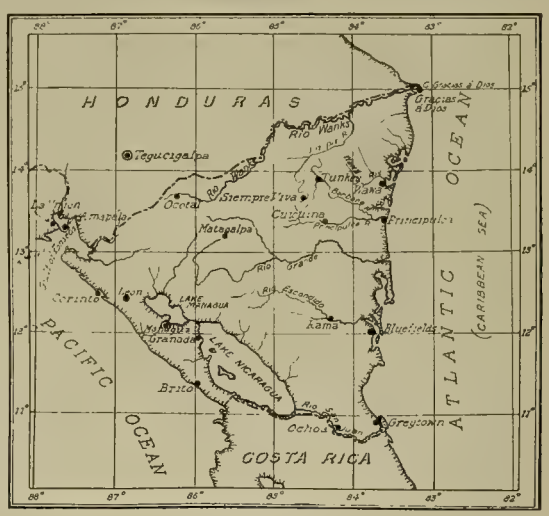
There has been a bad slump in the prices of the North Butte Copper and the Rawhide Coalition mining companies' shares on the New York Curb. Heavy selling of the Montana company's shares was started on the Boston Curb by rumors that the copper ore in the bottom level of the mine is so low as to be unworkable. The Rawhide selling was due to some peculiar tactics of the chief promoter, the ex-convict Herzig, who has lately been doing business under the name of George Graham Rice. For many months Herzig and his partner, Nat Goodwin, have carried on an extensive advertising campaign and stock has been widely placed.

The Curb Market Committee in New York having decided to weed out a number of the undesirable mining companies whose stocks are quoted on the Curb, E. S. Mendels, the committee's secretary, requested all companies whose shares are quoted on the Curb to furnish the committee with their latest reports, maps of mines, engineer's and manager's statements, financial statements, and all other data necessary in estimating their present standing and prospects. The committee proposed to keep itself informed of the operations of all mining companies whose shares are quoted on the New York Curb, and will suspend all companies who refuse to supply the information, which will be filed and open for public inspection. The following companies, having failed to file the necessary information, are hereafter only to be quoted as unregistered: The Banner Mining Co. of Goldfield, Bingham Argentite, Consolidated Red Top Lease Co., Cananea & Globe Exploration & Developing Co., Christmas Wonder, Ely Witch Copper Co., Elkhorn, Fairview Falcon, Galena King, Goldfield Ore Mining Co., Gold Belt, Golden Sceptre, Great Bend Extension, Goldfield Lucky Boys Mining Co., Hannapah Mining Co., Kewanas Mining Co., Link Chain Belt Co., Lone Pine, Manhattan Atlas, Mayflower Extension, Peerless Bullfrog Mining Co., Prairie Bell, Queen Alexandra, Right of Way, San Pedro Mining Co., Sandstorm, St. Ives Mining Co., Tramps Consolidated Extension, West End Consolidated Mining Co., and Watts Mining Co. The secretaries of several of the above-named companies have informed the committee that the desired information is being prepared and will be submitted shortly. It is therefore probable that some of the companies will be reinstated.

MANAGUA, NICARAGUA.

Banbana Concession.—Currency Depreciation.—Wage Scale.—Mining Taxes.—Leonesa Mine.

Nicaragua seems to be attracting increasing attention. Henry F. Lefevre is due in Bluefields in a few days to examine a concession on the Banbana river, for Minor Keith, well known in connection with the United Fruit Co. and railroad building in Costa Rica. The concession consists of 2½ kilometres on either side of the river and all of its tributaries; it concedes all the undenounced mining land on the Banbana from its source to its junction with the Bana Cruz. The option-price is said to be $250,000 gold, but as the ground is entirely unexplored, it is doubtful whether it will command cash. It would be like 'buying a pig in a poke'. The concession grants certain other rights, such as the free use of timber on Government land, the right to run steamers on the river, and the free introduction of supplies. The latter is a privilege already provided by law, and of no value unless it be stretched to include other merchandise. This would, of course, be bitterly contested by the merchants in Bluefields. The Government is anxious to get foreign capital interested in mining, and in consequence the mining laws are very liberal. The greatest drawback to development is the scarcity of labor and the depreciation of Nicaraguan currency. This can perhaps be overcome by raising wages and thereby attracting workmen



Map of Nicaragua.

from Honduras and Salvador. The present scale is as low as in the Far East. Laborers get $1.40 paper per day; miners, $2.25; trammers, $1.90, of which they pay 40c. paper for food. The present rate of exchange makes the paper dollar worth about 10½ to 11c. gold; a miner on day's pay, therefore, makes 25c. gold per day. On contract he can make $3 to $5, or about 33 to 35c. U. S. currency.

The only tax on the industry is an export duty on gold, amounting to about 85c. gold per fine ounce. This duty is payable by means of bonds issued by the Government for purposes of paying taxes. These bonds must be bought from the holders, who are usually speculators, and this to some extent introduces an element of uncertainty. President Zelaya is the most broad-minded of the Central American presidents, and has shown himself the friend of foreign capital. If he appreciated how distasteful it is to the mines to pay a tax in that way, he would undoubtedly have established a more equitable method. Many of the mining companies object to the gold tax. In itself the tax is not objectionable, so long as it is not exorbitant, and is fixed, but foreign capital wants to be assured of stability. There are enough variables connected with mining without the fluctuation of political and economic conditions. The Leonesa mine is getting ready to operate on an extensive plan, and another twelve months should make a big mine of it.

WASHINGTON.

Senate Tariff Changes.—Mineral Lands.—California Debris. — Mine Rescue Work.—Schools of Mines.

The work done by the mining interests, especially the protest of the lead-ore producers of Idaho, Utah, Colorado, and Nevada, had an effect, as is seen in the Senate amendments. The tariff bill will probably pass in the amended form. The paragraph referring to lead is as follows: Lead-bearing ore of all kinds, 1½c. per lb. on the lead content; lead dross, lead bullion or base bullion, lead in pigs or bars, 2⅛c. Lead in sheets, pipe, shot, glaziers' lead, and lead wire, 2½c. The provision regarding zinc is: Zinc ore and calamine, 1c. per lb. on the zinc content. Zinc in blocks or pigs, 1c. per lb.; in sheets coated or plated with nickel or other metal, 1½c.; old and worn out, fit only to be re-manufactured, 1c. Iron ore is taken from the free list. Iron in pigs, spiegeleisen, ferro-manganese, wrought and cast scrap-iron, and scrap-steel, $2.50 per ton. Alumina, hydrate of, or refined bauxite, containing not more than 64% alumina, ½c. per lb.; more than 64% alumina, 0.7c. The duty on baryta, including barytes earth, unmanufactured is reduced from $1.50 to 75c. per ton. Sulphur, refined or sublimed, and brimstone, advanced beyond the original condition as mined, $6 per ton. The duty on plaster rock or crude gypsum is reduced from 40 to 20c. per ton. Aluminum, aluminum-scrap, and alloys of any kind in which aluminum is of chief value, crude, 7c. per lb.; in plates, sheets, bars, and rods, 11c.; barium, magnesium, sodium, and potassium, and alloys of which said metals are the component material of chief value, 3c. and 25% ad valorem. Antimony, as regulus or metal, 1c.; antimony ore, stibnite and matte containing antimony, 1c. on the antimony content. Chrome or chromium metal, ferro-chrome or ferro-chromium, ferro-molybdenum, ferro-phosphorus, ferro-titanium, ferro-tungsten, ferro-silicon containing more than 15% of silicon, ferro-vanadium, molybdenum, titanium, tantalum, tungsten, or wolfram metal, valued at $200 per ton or less, 25% ad valorem; valued at more, 20% ad valorem; ferro-silicon containing not more than 15% silicon, $4.

William H. Andrews has introduced in the House a bill which provides that hereafter all gold, silver, and quicksilver deposits, or mines, or minerals of the same, on lands embraced within any land claim confirmed or hereafter confirmed by the decree of the Court of Private Claims, and which did not convey the mineral rights, are to be declared free and open to exploration and purchase under the mining laws of the United States. The bill contains the proviso that before the locator begins condemnation proceedings for the property he shall tender to the owner of the land the sum of $2.50 per acre in full payment for the surface ground, and the receipt of this sum shall authorize the immediate entry of the locator on the land. Another bill authorizes the Secretary of the Interior to sell any of the unappropriated non-mineral desert public land for $1.25 per acre. The money derived from such sale is to be placed to the credit of the Reclamation Service. Duncan E. McKinlay, of Santa Rosa, California, has introduced a bill appropriating $400,000 to carry out the plans of the California Débris Commission on the Sacramento and Feather rivers.

Stations for the training of miners in rescue work have been established by the Frick Coke Co., which employs 30,000 men at Connellsville, Pa.; the Consolidated Coal Co., of Maryland, at Fairmont, West Virginia; the Pittsburg Buffalo Coal Co., at the Marianna mine in Pennsylvania. This is a direct outcome of the demonstrations in rescue work being made by the Technologic branch of the United States Geological Survey. Senator Dick of Ohio, chairman of the Senate committee on mines and mining, has introduced a bill to apply a portion of the proceeds of the sales of public lands to the endowment of schools or departments of mines and mining. Each school is to receive next year, if the bill become a law, $15,000, with $1000 additional each succeeding year until the appropriation reaches $25,000. The money is to be spent for instruction, research, and experiment. Representative Richard W. Austin of Knoxville, Tennessee, has introduced a bill asking for the establishment of a mining experiment station at Knoxville, Tenn. This is one of many bills providing for the assaying of minerals by the United States Government in behalf of citizens. A geologist and chemist would have charge of the station. Senator Heyburn of Idaho proposes the payment of a tax of 10c. per acre yearly on all land held by any corporation, association, or person, which is held in connection with the conduct of any interstate business, or from which any article entering into interstate commerce is taken. A second bill provides that all corporations, persons, or associations holding lands in excess of 1000 acres shall pay an annual tax of 10c. per acre on such excess.

Simon Guggenheim, Senator from Colorado, could not keep out of the Western land question, and yesterday introduced a bill giving prospectors and miners the right to enter any of the forest reserves to locate claims and acquire title to them under the laws the same as on any of the public lands. The bill also provides that duly incorporated canal, ditch, or reservoir companies shall have the right-of-way through forest reserves and upon all public lands. Mr. Guggenheim also introduced a bill providing for instruction in forestry in the colleges of agriculture and for experiments in forestry in the agricultural experiment stations.

GOLDFIELD, NEVADA.

March Output.—Consolidated Production.—April Yield.

Official returns from high-grade ore shipped to the smelters by the Goldfield Consolidated Mines Co. during March show net earnings materially in excess of the estimates made by J. K. Mackenzie, manager. The expense of production has been reduced from $6.31 per ton in February to $5.85 in March. The detailed figures are: Number of tons mined, 19,503; number of tons milled, 19,150; number of tons shipped, 352; gross earnings, $1,081,872; gross expense $117,543; net earnings, $964,329; net returns from ore shipped, $215,599. Expense per ton: mining, $3.43; milling, $2.32; transportation, $0.103; total, $5.85. In the mining expense is included new development, salaries, office and legal expenses. The cost of treatment in the new mill is now $2.005 per ton. Last year the expense of mining was given as $6.14 per ton, and milling $7.14. Dividend checks, more than 5000 in number, will be mailed on April 30. This dividend will entail the distribution, at the rate of 30c. per share, of $1,063,803. The output for April will exceed the yield for March. Shipments of high-grade ore from the Hampton stope have been resumed at the rate of a car daily. Three cars which sampled $700 per ton have been shipped. No regular clean-ups are made at the Consolidated mill, and until final returns from the Mint are available, results for any given period can only be estimated. The estimates thus far made by the management are shown to have been conservative.

With only a portion of the bullion returns received, the output of the mines and mills of Goldfield for the first 14 days of April is estimated at more than $900,000 gross. This includes 9600 tons of $45 ore treated by the Consolidated Co., besides 320 tons of concentrate, valued at $300 per ton, which had been stored awaiting treatment; a total yield from the company's operations of $528,000. The Florence Goldfield mill treated 1500 tons, valued at $25 per ton. The Nevada Goldfield mill handled 1500 tons of $50 ore, including a daily output of 90 tons from the Combination Fraction mine. The samplers of the Western Ore Purchasing Co. handled 1600 tons, of a value of $165 per ton. The sampler's figures include high-grade ore from the Florence mine, the value being estimated at $50,000. The high transportation and smelter charges will greatly reduce the net profits on this ore.

The Daisy mine is developing ore of excellent quality at three horizons, and the cross-cut at the 500-ft. level will soon reach the cross-fissure in which the richest ore of the Diamondfield district has been found. In the meantime the main shaft is being rapidly sunk to the 700-ft. level, and daily shipments are being sent to the samplers, the ore averaging about $150 per ton.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Metallic sulphides are soluble to a slight degree in ordinary rain-water. This solubility is greatly increased where one sulphide is in the presence of another.

An acre-foot of water is the quantity which will cover one acre to a depth of one foot, 43,560 cu. ft., or 325,857 U. S. gal. This is equivalent to a stream-discharge of 0.5042 cu. ft. per second.

Aluminum is manufactured by electrolysis with carbon electrodes of aluminum oxide held in solution in a fused bath of cryolite and fluorspar. Works controlling 120,000 hp. are now engaged in its manufacture. Approximately 4 hp. per year are needed per ton of metal produced.

Germs find favorable conditions for growth underground, and sanitary precautions should consequently be taken with scrupulous care. Typhoid fever germs, once introduced into a mine, are difficult to eliminate. Sanitary closets should always be provided. These should be taken to the surface and cleansed daily.

Commercial sulphuric acid always contains many impurities, chief among which are arsenic, antimony, lead, copper, iron, and even bismuth and tellurium. These impurities may be thrown down by passing through sulphuretted hydrogen. Acid made from Mississippi Valley ores is generally free from arsenic; this gives them an advantage at smelters where the acid is recovered.

Illuminating gas requires for its manufacture an expensive plant. Coupled with this is an equally expensive system of distributing mains. The capitalization of gas plants is necessarily high, and the fixed charge to meet interest requirement is the largest element in the sale-price of gas. It is because of this, as well as the essentially non-competitive nature of the business, that the cost of gas is often underestimated.

Vacuum-pan evaporation is evaporation facilitated by producing a vacuum above the fluid to be volatilized. It is always aided by applying heat, either externally or through steam coils. The method is used in salt and sugar manufacture and in the chemical industries generally. It is more economical to utilize heat-energy by developing power and applying it through a vacuum pump. This creates vapor-tension and promotes evaporation.

Arsenic is found commonly as realgar and orpiment, both being sulphides, and abundantly as mispickel (FeAsS), and is associated with sulphur and antimony in a great variety of minerals. It occurs rarely as an oxide in the processes of alteration. The sulphides of arsenic are insoluble in water, but the disulphide is dissolved slowly in alkaline sulphide solutions. The trisulphide, however, passes into a colloidal state which is soluble in water.

The Cornwall has the largest output of any iron mine in the Eastern States, and was fifteenth in rank in 1907. It has yielded 20,000,000 tons of ore from practically one orebody. The mine is in Lebanon county, Pennsylvania. The ore is essentially magnetite, though pyrite is present in sufficient abundance to require that the ore be roasted. The ore occurs in sedimentary rocks near the contact with masses of intrusive diabase.

Copper sulphides are far more stable than iron sulphides, and resist oxidation to such an extent that it is probable chalcocite will not yield except through ionization in the presence of certain salts in solution. Ferric sulphate forms readily, however, and reacts according to the following equation:

$$Cu_2S + 2Fe_2(SO_4)_3 = 2CuSO_4 + 4FeSO_4 + S.$$

Ferric sulphate is an energetic solvent for gold, as is cupric sulphate also. Both salts readily reduce to the 'ous' state, and precipitate dissolved gold.

Quartz-glass, which is pure silica fused in an electric furnace, possesses the advantage of being free from any alkaline ingredient, of possessing a melting point 800° C. higher (1800 to 2000° C.) than that of ordinary glass, and in not being fractured by sudden changes of temperature. Red-hot quartz-glass may be plunged into cold water without breaking. It is neither hygroscopic nor soluble in acids, and alkaline solutions affect it less than they do common glass. It is now used for combustion tubes, beakers, and evaporating dishes in laboratories.

On the Comstock lode the main fissure is 10,300 ft. long. The valuable ore was found in it and in the southeast branch. The dip of the vein varies, as does also the strike. At the Belcher mine the dip is 32, at the old Sierra Nevada shaft 51°. The biggest bonanza, that of the Con. Virginia and California mines, was in the branch fissures of the hanging wall. The Sutro Tunnel, cutting the vein at 1865 ft., drained the upper workings, and water from the deeper workings was pumped up to it. The deepest mining was at 3080 ft. in the Yellow Jacket, at 3250 ft. in the Combination shaft, and at 3308 ft. in the Mexican. This was in 1884. The productive portion of the lode was mainly above the Sutro Tunnel, the deeper exploration proving disappointing.

Mine-waters frequently receive accessions from mills, works, and town-drainage in the vicinity, which could be trapped and carried off. The connection between the source of contamination and the mine is often difficult to establish. A convenient means is to introduce lithium chloride into the waters suspected of seeping into the mine. A gallon of concentrated solution introduced by constant drip through a 24-hour period will usually suffice. Samples of the mine water should be taken at regular intervals for a number of days thereafter, evaporated, and the residue tested spectroscopically for lithium. This is sensitive to one ten-millionth of lithium in the salt examined. The mine-waters, of course, must be previously tested for that element, but it is a substance rarely found in natural waters.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Panama Canal.

The Editor:

Sir—In your issue of March 27 were some personal animadversions made by Cassius E. Gillette. I regret these were published before being submitted to me, so that my position might have appeared in the same issue. The intimations of political chicanery are unworthy of notice, but in behalf of honorable men living and dead, as well as of the profession, it seems that the erroneous statements which have been made impugning the character and motives of my associates demands a refutation. Your correspondent, like myself, is a graduate of the West Point Military Academy and ex-member of the Corps of Engineers, and has consequently had the same preliminary training. He calls attention to a discussion relative to harbor-bar improvements, and to a system which I have developed whereby a portion of a single jetty is made to scour out a channel by utilizing the forces of nature, thus producing reasonably self-maintaining works at less than one-half the cost of the older Continental system. This invention and discovery was endorsed by competent experts in scientific societies and by juries of international exhibitions. In 1887, it was submitted to the U. S. Board of Engineers for use in this country, accompanied by the request that it might be tested at any point which the War Department might deem suitable, without expense to the Government, save for results secured. This body filed a report condemning the system as having no value and containing nothing new. I then applied for patents as a basis for the organization of a construction company to make guaranteed tenders to the Government to create channels at less than half the cost of the existing plans, and to take compensation only for the depths as secured. There was nothing like "A central trust in New Jersey, with local companies . . . which could have a secret membership covering local politicians capable of influencing the National Government to adopt the Haupt plan." After thus drawing upon his imagination as to the possibilities of crookedness in the introduction of a system so highly endorsed and giving such great promise of success and economy that Congress did finally adopt it, in spite of the strenuous opposition of the Corps of Engineers, your correspondent relieves me from the intent to err by stating, "I really doubt if Mr. Haupt appreciated the enormity of his proposition." He then proceeds to cite another hearsay story to demonstrate my incompetency as a member of the Isthmian Canal Commission. He states that I had objected to the unit-price as being too high, and that "nine pairs of astonished eyes were turned on Mr. Haupt at this, and he withdrew his suggestion." There is no truth in the story, and it may illustrate the unreliable nature of the communication to add that as there were only nine members on the Commission, I must have been one of those who looked on myself in astonishment. The facts are that each engineering member submitted a schedule, in writing, and the averages were then tabulated and discussed.

The Reaction Jetty Co., which was composed of experienced engineers, lawyers, and men of affairs, who had faith in the merits of my plans, made tenders for the removal of the bars at the mouth of the Mississippi. The Government plan called for an expenditure of $13,000,000, with an annual maintenance charge of $390,000, but with no guarantee of results. The company proposed to put up bonds for the faithful fulfilment of its contracts, if granted, and to procure a 35-ft. channel for $6,000,000. This had the effect of bringing the Government estimate down to the same figure, but in doing so, and in order to reduce cost, the plans were so modified as to place the jetties so far from the channel as to render them almost useless. It also compelled resort to dredging, despite which the channel has not been scoured, and larger dredges are now being built. The bar meantime has moved gulf-ward, and is now more than a half a mile beyond the works, which are to be extended at additional cost. A similar guarantee was submitted for the mouth of the Columbia river at a cost of $2,500,000, which was referred to a Board of Engineers of which your correspondent was a member. After some eight months of consideration the Board finally made a report from which was suppressed all reference to the company's proposal, and the company was denied the right to review or even to examine the said report, although the Board was a special one appointed to consider and report upon its proposition. Your correspondent is stated to have remarked to his superior officer, in the presence of the counsel of this company, that to entertain favorably such a proposal as the company had made would be revolutionary, and it should not be done; or words to that effect. He had not forgotten the experience of James B. Eads in opening the South Pass of the Mississippi on a similar basis, which was so great a relief to the country, but which had been opposed by the Corps of Engineers. The above few instances out of many are cited to illustrate the conditions which have resulted, as our late energetic president has stated, in the work on our rivers being "largely negative." In this valedictory he said: "We have spent hundreds of millions upon our waterways," and he deplores, "the utter waste caused by the methods which have hitherto obtained," adding, "We should have a new type of work and a new organization for planning and directing it. The time for playing with our waterways is past. The country demands results."

LEWIS M. HAUPT.

Philadelphia, April 2.

The Editor:

Sir—I read yesterday in a copy of the MINING AND SCIENTIFIC PRESS of March 27 a communication signed by Maj. Cassius Gillette. Without going into any discussion of the subject matter of Major Gillette's communication, I wish to take exception to

his reflections concerning Professor Haupt. I was a student at the University of Pennsylvania when Professor Haupt was head of the Department of Engineering; I was afterward associated with him as instructor and assistant professor; and for some years after my graduation from the University was also his business partner; all of which connections have given me an intimate knowledge of his character, and I desire to state that in all my associations with him I found nothing that would indicate any ground for the grave charges which Major Gillette's statements by innuendo and insinuation seem to imply

BENJ. FRANKLIN.

Philadelphia, April 7.

The Editor:

Sir—In your issue of March 27 you publish a letter from Cassius E. Gillette reflecting upon the honesty and professional ability of Lewis M. Haupt. I do not know what has inspired this attack. I have known and respected Mr. Haupt for over twenty-five years. Whatever may be his faults, this is the first and only time I have ever heard his honesty questioned; I am sure no one who knows him well will believe these statements.

I dislike public controversies, and it is only a sense of loyalty to an old friend that impels me to indite this communication. I understand that Mr. Gillette claims to belong to the mining engineering profession, although I have not understood that he has been accorded recognition as such by the reputable old-line members of that branch of the engineering fraternity. As I do not know Mr. Gillette personally I have no means of judging his ability in this respect, except what I can glean from his reports, which is far from favorable.

Mr. Gillette is, I understand, a West Point Military Academy graduate, and was formerly in the Corps of Engineers. Some years ago he came to Philadelphia to install a system of sand filtration, and in order to accept a supposedly permanent position under the City he resigned from the Army. It is no reflection upon him that he lost this job through political exigencies. That he should then undertake to earn his living as a civil engineer is quite natural and proper; and even if he should subsequently become a mine promoter, that is a perfectly legitimate action, provided he gives up engineering. The curriculum at West Point does not, I understand, contemplate preparing men for geological and mining work, and Army engineers, as a rule, are not expected to develop into geologists and mining engineers.

F. LYNWOOD GARRISON.

Philadelphia, April 3.

The Editor:

Sir—The contribution by Cassius E. Gillette under the above heading, in your issue of March 27, seems to cast doubt upon the professional ability and honesty of Lewis M. Haupt. I am surprised and pained that you should publish the article without giving Mr. Haupt an opportunity to reply in the same issue. From a personal acquaintance of more than 35 years I know that Lewis M. Haupt stands too high in the public esteem to be reached by innuendoes of this kind, no matter how cunningly they may be worded. While I do not know Cassius E. Gillette, I was astounded at this article, for I believe Gillette and Haupt are both West Point graduates, and I presumed professional courtesy should have made such an attack impossible. My astonishment was such that I felt impelled to enquire into the standing of the author of that article to learn what weight should be accorded to his utterances. Not being personally acquainted with him, my information is based mainly upon hearsay. From enquiries I have made, I am informed that he resigned from the Army Corps of Engineers some years ago, and recently has maintained an office in Philadelphia as 'Consulting Engineer', and has accepted a number of engagements to make geologic and mine examinations, and to advise upon the value, development, and management of mining properties. After somewhat careful enquiry, I fail to learn that he has had previous mining experience which would qualify him for such work.

It seems to me that some way should be provided whereby the qualifications of those practising as mining engineers may be readily determined. The subject is one that could properly be taken up and discussed by the Mining and Metallurgical Society. The uneducated pretender is not especially dangerous, either to the public or to the profession, but if men of education, especially of engineering education, having the prestige of prominent social or business connections, are permitted to practise a profession for which they were not trained, then that profession or the public, or both, must surely suffer.

Aside from the apparent reflections upon Lewis M. Haupt, the article in question is remarkable for the impertinence and audacity of the author in presuming to express a patronizing approval of your editorial, 'ideas on mining geology and mine finance'.

H. M. CHANCE.

Philadelphia, April 10.

The Editor:

Sir—Probably no engineer enjoys more fully or more deservedly the confidence of his colleagues in his integrity than does Lewis M. Haupt. Indeed, those of us who have known him for a quarter-century or more have come to regard him as one of those persons who are "so upright that they lean over backward." It must therefore be a surprise, to Mr. Haupt's many friends, to read, in your issue of March 27, a communication from Maj. Cassius E. Gillette, under the heading, 'Panama Canal', closing with a paragraph which, at first sight, appears to reflect very seriously, not only upon Mr. Haupt's professional equipment, but also upon his moral character; and they will be correspondingly relieved to find, upon a scarcely less cursory review of the paragraph, that it is, on the whole, rather complimentary to Mr. Haupt, and in only one matter derogatory.

Major Gillette says that he is quite familiar with Mr. Haupt's personal equation, including his capabilities as an engineer. This, of course, involves no reflections upon Mr. Haupt, notwithstanding that

Major Gillette's familiarity with the personal equations of others (through which he has become noted) has sometimes resulted unfavorably to those equated. Referring to a discussion between Mr. Haupt and himself, Major Gillette says: "a careful reading of the matter would repay you for the time involved." In justice to the Major, we must assume that his applause is not intended exclusively for his own share of the discussion. Major Gillette tells us that "Mr. Haupt organized a company to promote his peculiar 'jetty theory'," and that "the plan was to have a central trust in New Jersey, with local companies wherever harbor improvements were to be made by the general government." This, of course, is merely to the credit of Mr. Haupt's business enterprise and of his faith in the soundness of his theory. Major Gillette remarks that "these companies could have a secret membership, covering local politicians capable of influencing the national Government"—a statement which, in its conditional form, is applicable to companies in general. Major Gillette doubts "if Mr. Haupt appreciated the enormity of his proposition," thus paying at least negative tribute to Mr. Haupt's moral sense, whatever the enormity may have been.

Major Gillette is reliably informed that "there were nine pairs of astonished eyes turned on Mr. Haupt," when he protested against the adoption, by the Isthmian Canal Commission, of certain unit figures (which he thought were very high), on the ground that such adoption would "kill the whole canal proposition," and that Mr. Haupt thereupon "abandoned his suggestion." This charge, of having abandoned, under fire, a perfectly proper suggestion, is the only one I find in Major Gillette's communication, and those who know Mr. Haupt will find it difficult to picture him abandoning his colors, even though ninety-and-nine pairs of astonished eyes were turned upon him.

JOHN C. TRAUTWINE, Jr.

Philadelphia, April 8.

Zinc Ore from Mexico.

The Editor:

Sir—In your editorial of March 24 on the production of zinc, you state that "the increase of 25% in importations of ore from Mexico in one year challenges attention."

The MINING AND SCIENTIFIC PRESS is distinguished for its accuracy, but in this instance it would appear that a mistake has been made. The Fiscal Bulletin published in Mexico by the Department of State in 1908 gives the exportation of zinc ore from Mexico as follows, for the 12 months ending June 30, 1907:

	Metric tons.
To Germany	2,284
To Belgium	12,669
To United States	82,614
Total exports	97,567
Value	₱2,010,408

From advance sheets of the Fiscal Bulletin for 1908-'09, kindly forwarded to me from Mexico, the exports of zinc ore for the 12 months ending June 30, 1908, are given as follows:

	Metric tons.
To Belgium	4,282
To United States	37,877
To England	1,180
Total	43,339
Value	₱888,474

You will note that instead of an increase in the exportation of zinc ore from Mexico, there was a decrease to less than one-half of that of the year before. I have no accurate figures covering the production for the latter half of 1908, but know that there was no increase in the tonnage shipped such as your figures would indicate.

JAMES W. MALCOLMSON.

Kansas City, March 30.

Lake Copper.

The Editor:

Sir—We have had the impression, on what appeared to be good authority, that the Lake Copper produced by the Calumet & Hecla Mining Co. sold at a better price than that of any other Lake company. The following taken from elaborate tables, furnished by the respective companies in the suit of A. S. Bigelow *v.* the Calumet & Hecla Mining Co., show that the product of this company and that of the near-by Osceola sold at practically the same figures in 1905 and 1906:

		Pounds.	Average gross price, cents.
Deliveries in 1905	C. & H.	74,045,970	15.54
	Osceola	16,708,117	15.46
Deliveries in 1906	C. & H.	94,336,600	18.406
	Osceola	22,174,669	18.57
Deliveries in 1907	C. & H.	34,756,200	21.82
	Osceola	6,776,295	21.607
All sales, 1905-06	C. & H.	203,168,720	17.945
	Osceola	45,659,081	17.898
All deliveries, 1905-06	C. & H.	168,412,570	17.14
	Osceola	38,882,786	17.23

It will be noted that part of the copper sold in 1906 was not delivered until 1907, and that the total sales for the two years is to be made up by adding the copper delivered in 1907 to that delivered in 1905-06.

L. S. AUSTIN.

Houghton, March 22.

What Is an Ore?

The Editor:

Sir—James F. Kemp's definition of 'ore' in your issue of March 20 seems to me still open to one objection. I feel great delicacy in offering any sort of criticism on anything written by one of such recognized ability, and particularly as I have always regarded a remarkable clearness of language as one of the striking characteristics of Professor Kemp's writings; but the term 'profit', as used in his proposed definition, seems to need either an explanation or a substitute.

Suppose a miner sells a lot of ore for $1000. The cost of production is first estimated at $990. Then

it is ore. But some more critical accountant calls attention to the fact that no items of interest on the investment and amortization have been included, which might bring the cost above $1000. If so, it is not ore. On amortization it is necessary to consider all prior production and the remaining value of the mine. This would likely require years to determine. Must we wait for a future generation to decide the name of the thing we are dealing with? Suppose it be definitely decided that, after gathering every item chargeable, the cost of production amounts to $1000; yet that sum went to benefit somebody; if both the mine and the smelter lost money in handling it, still the railroad may have made a profit exceeding the combined losses of the mine and the smelter. If the mine, the railroad, and the smelter all lost by the operation, still it may be that the wages of the employees of all three added to the wealth of human society—that the net amount so added exceeded the combined losses. Again, a miner, in driving along a vein to reach a known ore-shoot, encounters and saves some material which he sells at $5 per ton. It has cost him $10 per ton to mine and market it, but he would have driven the same drift had it not produced a pound of saleable rock. Then the $5 per ton for whatever he could market was just that much salvage. In other words, his necessary dead development expense is reduced by whatever returns he can secure from any sales of material which has to be broken in the progress of the work. In every large mine, having a complicated system of veins, 'development ore' is a regular item in the accounts. In this is classed all of the product which falls below the combined cost of mining, transportation, and reduction and above the combined cost of transportation and reduction, but it is valuable and goes to the smelter. Take another illustration: A miner has to choose between driving a cross-cut adit 500 ft. through entirely barren country, costing $5000, or following an unprofitable portion of the vein for 1000 ft., costing $10,000, to reach a known pay ore-shoot. He estimates that the 1000 ft. of drift on the lean vein will yield $6000 in returns from material that can be marketed. Thus he deliberately plans to expend $10,000—$4000 more than the estimated returns—because that will amount to $1000 less than the 500-ft. cross-cut. The case of the pile of magnetite purchased at a bankrupt sale is another example. These examples represent a phase of mining not at all extraordinary. In all cases something was produced which was not profitable, yet entered into the commercial activities of the world and benefited someone, and that thing must have a name. I think it should be 'ore', and I believe that a miner, a jury, or a judge would so pronounce it, and "use is the law of language."

The definition might be modified thus: In a scientific sense an 'ore' is a metalliferous mineral belonging to the group of those which have commercially yielded the metals to the world's wealth. In its technical sense an 'ore' is a metalliferous mineral or an aggregate of metalliferous minerals, more or less mixed with gangue, and capable of being won as a commercial operation, adding in any way to the world's wealth. The last phrase may be unnecessary. Or: in its technical sense an 'ore' is a metalliferous mineral or an aggregate of metalliferous minerals, more or less mixed with gangue, in sufficient quantity and consistence to institute commercial operations. Instead of eliminating the word 'profit', some might prefer to introduce an explanatory clause to cover such cases as those above mentioned; but such an explanation would be tedious and beset with serious difficulties. No one will belittle the difficulty of giving a definition that is both satisfactory and concise.

V. G. Hills.

Denver, March 27.

Mining Cost in Mexico.

The Editor:

Sir—The enclosed cost-sheet may be of interest to the general mining public as showing what development work is done for at the San Francisco mine in southern Mexico, and you are welcome to publish the figures as given. All work is done double-handed and under contract. The vein is hard quartz, and all winzes and raises have a cross section of 1.4 by 1.3 metre.

DEVELOPMENT COSTS IN OAXACA.

Development for month, metres	134.95
Dynamite used, kilograms	471.59
Fuse used, metres	1570.00
Caps used, 5X	2298
Candles used, native dip	4271
Direct cost—Supplies	₱ 754.10
Labor	1957.96
Total	2712.06
Direct cost per metre—Supplies	5.79
Labor	14.52
Total	20.11
Total cost per metre	36.90
Equivalent cost per foot (U. S. Cy.)	$5.62

A cross-cut tunnel was started March 1, 1908, and to March 1, 1909, the advance was 240.00 metres, an average rate of 0.65 m. or 2.15 ft. per day. The total cost, everything included, was ₱7567.45, or ₱31.50 per metre, or $4.80 gold per foot. The cross-section of the tunnel is 2 by 3 metres, and the material penetrated is augite andesite—fresh and hard.

E. J. Bumsted.

Taviche, Oaxaca, Mexico, March 6.

Mechanical Elevator.

The Editor:

Sir—I was much interested in your description of the mechanical elevator in use on Bonanza creek, Yukon Ter., and am disposed to believe that this or some similar apparatus will prove widely useful. Would you mind stating who built this elevator and from whom it may be obtained?

E. D. F.

Denver, April 3.

[The elevator in question was built by the Link-Belt Co. and supplied, we believe, through the Chicago office.—Editor.]

In small power plants of the size representing the average in use in factories, a gas-power plant is able to save so much coal that it can produce power at much less total cost than the steam-power plant.

MINING IN NORTHERN CHINA.

Written for the MINING AND SCIENTIFIC PRESS
By F. L. COLE.

Mining, in other than native fashion, is an unimportant industry in northern China, although the regulations that apply to northern China apply to the whole Empire. The mines north of the Yangtze river, at present worked solely by foreigners, joint foreign and Chinese companies, or Chinese owned and under foreign management, number only about a dozen, and nearly all of them are coal mines. The few concessions that have been granted to foreigners in the past have had a more or less checkered existence politically, and at present it it not possible to obtain concessions on the liberal terms heretofore granted; in fact, it is difficult to obtain them at all.

Under the terms of the treaties made by China with Great Britain and the United States in 1902-04, China agreed within a year from the dates of those treaties to make mining regulations that would give reasonable opportunity for the investment of foreign capital. Various regulations have been made from time to time, also special ones for special concessions, and in 1907 regulations consisting of 74 articles and 73 supplementary articles appeared. Against these regulations, however, a protest was made by the Ministers of the different Powers at Peking, and it is stated that assurances were given by the Chinese government that better ones would be issued. These regulations, although particularly absurd and impossible, are practically in force today as far as native mines are concerned, and to some extent they also affect foreign interests. Excellent mining regulations have been submitted by capable foreign advisors, but up to date the Government has made no definite move toward making opportunities for foreign investors on reasonable terms without prolonged negotiations.

The Chinese government claims all minerals, irrespective of the surface rights of land-owners, and applications for mining rights have to pass the district and provincial authorities as well as the Imperial Board of Agriculture and Commerce, which at present has charge of mining affairs, and, in the case of foreign interests, the Imperial Board of Foreign Affairs also. The opportunities for obstruction, alteration, and the division of the spoils are endless; at the outset these constitute barriers enough to discourage the most optimistic, but those who have labored along those lines have generally succeeded in time in obtaining a satisfactory agreement.

Time is no object in China, the hurry bacillus has not reached there yet, and anyone contemplating mining had better go prepared for a long and expensive campaign of uncertain results. In the case of a coal mine to supply a certain railroad, both of which would contribute to the Government revenue, it took three years to settle an agreement for a foreign loan to operate the mine under joint foreign and Chinese management. Meanwhile the railroad was built by a loan from the same foreign syndicate and coal had to be obtained elsewhere. In another case of a concession granted to a foreigner for a coal mine, it took over five years to secure a satisfactory agreement for its operation. However, the foreigner commenced work before the negotiations were finished, thus doubtless hastening their conclusion.

The question of security for the investment of foreign capital for mining in China is an important one, as no foreigners, except missionaries, can own land outside of a treaty port. The fear of foreigners securing a foothold under the pretext of mining is always evident. At present there are no regulations that provide for any security, except in the cases of some individual concessions where rights extend over a period of years and the Government guarantees that the rights shall be upheld. Where loans have been made for railroad construction the principal and interest have been guaranteed by the Government, and also in some cases by the loan companies being allowed to operate the roads for certain lengths of time.

The Chinese have not been particularly well treated in many of their earlier agreements with foreigners, and hence are more conservative than they doubtless would have been had their first experiences been different.

The case of the absorption of the Chinese Engineering & Mining Co. (Kaiping coal mines, in Chili Province) by a British syndicate during the Boxer trouble has caused much hard feeling toward foreign investors generally. The Chinese have only a small portion of the shares of this company, and no voice in the management, though had the company been organized on joint lines, it is questionable if it would have been the prosperous undertaking that it is at present.

The general idea of the average Chinese official regarding a mine is that it is a hole in the ground which has some machinery on it for which good commissions are to be made in the buying, and that at any time this hole can be made to produce hard money in the shape of royalties or presents, regardless of its condition. The fact that a certain expenditure has to be made to put a mine in condition for production and that the output is not all clear profit, are mere minor considerations. Every industry in China has to support the greatest possible number of people, and everything that has to pass through various hands must leave its share in each.

Those foreigners who have been successful in obtaining mining rights in northern China have been helped by their respective governments; they have been principally British and German. The policy of the American government at present is to offer but little assistance to prospective investors. Without official help any undertaking is handicapped. The British and German governments are notably active in helping their subjects to obtain concessions of various kinds. It is expected that proper mining regulations will be forthcoming soon, but as five years have passed and the treaty obligations that were to have been fulfilled in one year are still in suspence, it is an interesting problem to juggle with. When satisfactory regulations do appear, a new field with great possibilities will be opened.

Chinese capitalists, as a rule, do not take kindly

to mining except when they are well acquainted with it, and then only in a small way, as the chances of their undertaking being absorbed by the Government are excellent, and they can use their money in safer ways. There is a tendency, however, at present for Chinese companies to open mines because the new railroads have given an impetus to coal mining. With the advance of railroad building we may look for an advancement in mining. Railroads are in fashion at present, as, so far, foreign money has been easy to obtain, and the handling of large loans has made competition keen for the important positions in railroad administration. When once the advantages of mines operated under foreign methods becomes a recognized fact there will be assured progress and opportunities for investment.

At present there is a growing demand for foreign engineering advice for Chinese mines, as up to date very few Chinese engineers have appeared with the necessary combination of theory and practice to achieve practical results. There are no keener business men than the Chinese bankers and merchants, and the rapid advance the country has made in the past ten years will no doubt have its effect upon mining in the near future.

There are many monuments of a mistaken policy, in the shape of old boilers and mining machinery, scattered over China, which have usually been sold by foreign merchants to Chinese who had but a vague idea of what their needs were, and the merchant cared less, as long as he could get his profits. If the merchant in many cases had been satisfied with a little less profit and had had an engineer to give advice regarding the needs of the particular mine, and some practical hints about the operation and management of both the machinery and the mine, the results would have been more sales and more mines. This is being done to some extent at present, with good results. Both the buyer and the seller are learning.

Coal is the principal asset of northern China, and it offers many opportunities for development, as the scarcity of other fuel makes a constantly growing demand. Railroad rates at present are very high, and Japan sells annually large quantities of coal to China. Very little iron has been found and worked, but the geological conditions are favorable in several provinces. Given iron, with the immense coal deposits and with the transportation afforded by the new railroads, together with the unlimited supply of good cheap labor, there is a great future ahead for the industry. Even without iron there are many possibilities in manufacturing that will make China a big exporter of many things that are now being imported.



Map of China.

There are known deposits of both that would doubtless pay to work. Gold is mined in many localities, but outside of the alluvial mines along the Amur river in northern Manchuria there are few places where it is produced on any scale. There are quartz mines that would pay if operated in a small way with foreign methods, and possibly some that would pay if operated on a larger scale. There are undoubtedly opportunities for

China is a well known buyer of silver and copper. Neither of these metals has been produced in quantity in the North, but there are known deposits of

dredging and other methods of alluvial mining. It is practically impossible to obtain any definite idea of the mineral output, as such a small amount passes through any source making statistics available.

Manchuria has been generally looked upon for some years as being fabulously rich in minerals, but up to date, with the exception of one large and two or three small coal mines of an indifferent quality of coal, partly developed by Russians and now being developed and operated by the Japanese, under protest from the Chinese, there are no mining developments in progress in which foreign capital is interested, nor have any concesisons been granted to foreigners since the late war. It is a significant fact that outside of the mines just mentioned there are no Japanese mining concessions in China.

According to the present mining regulations, it is possible for foreigners to obtain mining rights as equal partners with Chinese under joint management, but it is a slow process and, with the constant change of officials, not an attractive one, except under favorable conditions and with strong political backing. To those who have capital, influence, and patience there are undoubted opportunities.

Traveling in northern China is easy and comfortable, and when the foreigner remembers that there are some 400 million Chinese, and that to them their own ways and habits are the only ones, he has little or no difficulty. It is generally the fault of the foreigner if there is trouble. Transportation is good for the character of the country, the climate is excellent, and labor cheap and efficient.

There are many reforms needed to put mining on a sound basis. A topographical and geological survey of the mineral districts would be of great value and a fitting work for some of our benevolently inclined rich to undertake. There have been many foreign engineers and geologists in China, but the amount of available useful information relating to mining is small.

The general policy of the 'open door' has not so far succeeded in accomplishing much in the way of opportunities for mining. The Chinese have to be 'shown'; the present is a transition period of foreign innovation, but the way they have taken to foreign cigarettes, cotton cloth, kerosene, and machinery in the past few years is remarkable. The small number of American business houses in China is also remarkable. It is to be hoped that with the continued progress along other lines, mining will soon receive substantial attention from the government.

The cyanide assay for copper applied on the ores of Ely, Nevada, shows results which are as much as 0.126% too low unless the iron precipitate be re-dissolved. The precipitate was found to hold back 3.4% of the total copper present. The cyanide assay generally yields lower results than the iodide method.

A new index map of Alaska, showing areas covered by topographic surveys, has just been issued by the U. S. Geological Survey. On the back of the map is printed a list of the Survey's publications on Alaska, arranged geographically. These publications comprise 28 maps and 119 reports.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

C. M. & S. Co., Viesca, Mexico: Mimetite.

I. H. T.: A schistose quartz-conglomerate.

S. L., Oasis, California: A limy sandstone.

S. A. K., Wellington, Nevada: Galena and pyrite.

J. H. P., Golconda, Nevada: Quartzite with quartz druses.

A. L. C.: A gabbro, probably the variety anorthosite, with pyrrhotite.

W. H. B., Valdez, Alaska: Mixed pyrrhotite and pyrite in quartz.

C. E. H., Lewis, California: Black shale with calcite, color probably due to a minute amount of graphite.

R. J. H., Cumuripa, Sonora, Mexico: Metamorphosed andesite with developments of epidote and slight secondary quartz and calcite.

C. B. R., Helvetia, Arizona: No. 1, chlorite schist; No. 2, muscovite-chlorite schist. (Specimens too small for satisfactory examination.)

J. M. C., Fout's Springs, California: No. 1, impure crystalline limestone with pyrite; No. 2, coarse sandstone; No. 3, nodule of the oxides of iron and manganese; No. 4, calcareous shale.

C. H. E., Goldfield, Nevada: No. 1, pyrite in an altered rock (possibly an acid tuff); No. 2, quartz porphyry; No. 3, nondescript kaolin-silica aggregate with pyrite, probably an altered acid lava.

R. R. E. C., Medford, Oregon: No. 1, impure crystalline limestone; No. 2, quartz; No. 3, acid volcanic tuff; No. 4, limonite-kaolin rock with pebbles—a very fine gravel; No. 5, metamorphosed andesite or diabase.

T. B. B., Winnemucca, Nevada: No. 1, basalt, or possibly diabase; No. 2, shale; No. 3, sandy shale; No. 4, syenite or diorite porphyry; No. 5, greatly metamorphosed rock, originally diabase or possibly andesite. (Specimens too small.)

N. E. G., Red Rock, Arizona: No. 1, (a) gabbro, or diorite-porphyry; (b) copper-stained trap rock, probably diabase; No. 2, andesite, much altered and seamed with calcite; No. 3, quartz-calcite aggregate with hematite, malachite, and chrysocolla; No. 4, granite porphyry; No. 5, quartzite stained with malachite and possibly some chrysocolla.

The death is announced in Russia of Baron Horatio Ginsburg, who played a leading part in the development of gold mining in Siberia, and especially in the Lena region, where he amassed a vast fortune.

MINING METHODS IN THE NORTH.—IV.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

By the method of drifting, only the bottom layer of the gravel deposit was mined: any gold in the overburden remained untouched. The gold was not always concentrated on the bedrock, or even in the five or six feet immediately overlying, so that the engine. The pay, on bedrock, was dug by hand with pick and shovel, and then taken in wheelbarrows to the dump. Later, the self-dumping bucket was introduced; this traveled on a steel rope and was pulled by steam-power; it served to raise the gravel 30 to 40 ft., so as to afford plenty of tailing-discharge.

Another method was to set sluice-boxes in the open-cut itself, wherever there was an outlet at the level of bedrock. In rare cases, where natural drainage from the open-cut was not available, the water was pumped and the tailing was hoisted from the end of the sluice-boxes. No man was permitted to dump tailing on his neighbor's ground.



Open-Cut Method on Bonanza Creek.

On No. 15 Below Discovery on Bonanza creek, in the Yukon Territory, I saw a typical example of the open-cut method. The ground had been worked by 'drifting' several years ago and was thawed naturally to bedrock except for occasional patches of ice where water had gathered in old workings. This also had been thawed by stripping and subsequent exposure to the summer sun. First, the top 4 ft. of dirt is removed by means of a scraper operated by steam-power. The scraper, guided by a man, is pulled forward and backward by steel ropes attached to a gin-pole. When the overburden has been removed, the self-dumping bucket is applied. This bucket runs on a ¾-in. cable and is pulled by a traction rope of ⅜-in. diameter. The bucket is 3 ft. square and 18 in. deep, so that it holds ¾ cubic yard. It swings freely on a bail, attached nearer the top than the bottom. The discharge or 'tripping' is effected by a chain loop that is caught by a post near the terminal, the bucket dumping onto a baffle-board, which causes the gravel to slide directly into



On Discovery Claim, Cleary Creek.

method entailed waste. It was not complete. Also, there was danger of a collapse of the ground when the roof softened, by admission of warm air in summer or by penetration of surface water. Sometimes the mine caved, or the loosening of the ground was such as to increase the cost excessively. To the owners these delays might not be serious, but to the lessees it meant loss of valuable time. For most of the drift-mining was done by 'laymen', that is, men who worked the claim on a 'lay' or royalty. They were 'tributers' or lessees, contracting for the right to mine the ground on condition of paying a royalty to the owners. This royalty ranged from 25 to 60% on the gross yield. A 50% lay was common. As it meant giving the owner one half of all the gold extracted, it bore evidence both to the richness of the ground and the venturesome spirit of the operator.

To obviate underground excavation, the open-cut system was introduced. The overburden was removed with scrapers, pulled by horses or by a steam-

the sluice-boxes. The fixed cable can be anchored as desired, with the progress of excavation, and is kept taut by a counterweight, so as to permit the carrier or bucket to run back by gravity after it has been discharged at the upper terminal. The sluice-boxes, set on a trestle, are 12 in. wide and have a gradient of one inch per foot, but the first one or 'mud-box' (into which the gravel is discharged) is inclined at 20 in. per 12 ft. and is 3½ ft. wide. The attendant lifts any large (more than 2 in.) pebbles by means of a fork into a car, which removes them to a distance. Of the gold obtained, two-thirds is arrested in the first sluice-box, 12 ft. long, and one-third in the next 20 feet.

From 2 to 2½ ft. of bedrock (soft schist) was being removed, by pick and shovel. The material is conveyed in wheelbarrows to the bucket, which comes to rest at a fixed spot. By the time the bucket has made a complete journey, to the dump-box and back, the men working in the open-cut have filled their wheelbarrows and proceed to trundle them, in turn. Thus, while the movement of the bucket is intermittent, work is continuous. The wheelbarrows serve for storage while the bucket is away. There were 12 men at work in the cut on each of the two shifts; of these, 10 were digging, one was picking drains in the bedrock, and another was tending the bucket. In addition, there were: An engineer at the hoist, a boiler-man, a blacksmith, a man at the dump-box, another that attended to the tail-race, and a foreman. Thus there were 18 men per 10-hr. shift, or 36 in all. Wages were $4 and board, for most of the men. A few got $5, and the foreman $8, besides board.

In this way Andrew Horn was working this thawed deposit in Bonanza creek to a depth of 14 or 15 ft. Under such conditions it was profitable to exploit ground that yielded $1 per square foot of bedrock or about $2 per cubic yard. The stuff on bedrock ran 10 to 25 cents per pan, that is, $15 to $30 per cubic yard, for a thickness of 6 in. The 'layman' or lessee was clearing $40,000 in the season, of 4 months, after paying a royalty of 50% to the owner of the claim.

Another good example of the open-cut method was afforded by the operations on the Discovery claim of Cleary creek, in the Fairbanks district. This also is ground that has been partly worked in days gone-by. At the north or down-stream end of the claim 38,000 sq. ft. was being stripped of its overburden by means of two scrapers. The gin-pole had been erected at a point 250 ft. from the steam-engine that supplied the motive power. A scraper holding 19 cubic feet when full, or an average of half a cubic yard, was being pulled by a ⅝-in. steel rope. Two men guided the movements of the scraper by holding wooden handles having sockets into which the iron levers fitted. They held the scraper to its work and when it was loaded, one of them rode on the load as far as the dump, to tend the dumping. Thus a thickness of 9 ft. for an area of 38,000 sq. ft. was being shifted onto last year's bedrock, that is, the ground that had been worked out during the previous season. In this work there were employed 6 men and 2 scrapers. The labor included 2 engineers, 1 foreman, 1 man trimming the bank, 2 working with the scraper. There were 12 men per 24 hours, with a foreman. The last mentioned and the engineers are paid $7 and board; the others get $6 and board, worth $2.50 to $3 per day.

The seepage is removed by a pulsometer. Removal of the nearly barren overburden proceeds until the 'pay' is reached. The foreman watches for this, by digging an occasional hole and panning the gravel. As soon as he gets a yield of 2 cents per pan, he stops the scraping. The average thickness removed by the scraper is 9 to 10 ft. Then the self-dumping bucket is brought into use. It required 6 weeks to make the cut that I saw—38,000 sq. ft. by 9 ft. deep. The work was delayed by the necessity for thawing a few patches of frozen ground. This was done with steam-points. The scraper cannot be employed in ground that is not wholly thawed.

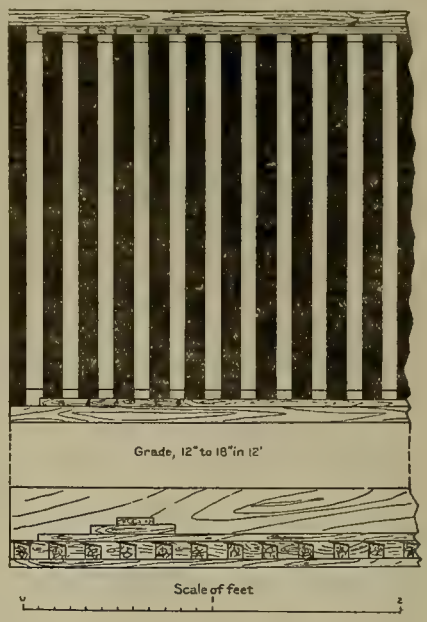
Next comes the mining in the gold-bearing portion of the deposit. This could be watched at the south end of the claim, where the bedrock was 17 ft. below the surface. Twelve feet of overburden had been previously removed by scrapers, in the manner just outlined, and the lower 6 ft. of profitable ground was being attacked. A self-dumping bucket, of the kind already described, elevated the gravel to the dump-box at the head of the sluice-boxes. About 2 ft. of bedrock and 4 ft. of sediment constitutes the 'pay.' The bedrock is a soft decomposed yellowish mica schist traversed by occasional bands of hard quartzite, especially near the rim of the channel, where it makes a blocky irregular bottom. Usually, however, the bedrock is very soft and the transition into the detrital deposit is indicated more by the color than by any marked change of texture. The deposit is a confused mixture of slabs and sub-angular pebbles of schist, resembling a talus. The gold is in the fine sediment intermingled with the larger fragments. The average yield in the season of 1907 was $5 per square foot of bedrock; thus 50,000 sq. ft. yielded $258,000. Stated in another manner, the yield was $20 per cubic yard for the total 20 ft. excavated. The best run in the Fairbanks district was made on this Discovery claim last summer: In 52 hours, 7 men with wheelbarrows extracted gravel that produced $27,500. The period included 6½ days of 8 hours each; the cut had been stripped to the pay, and the work represented the removal of the bottom.

Operations proceed both by night and day. Three arc lights illuminate the workings by night. Thus in the season of 1908 no less than 70,000 sq. ft. of open-cut had been stripped at the time of my visit, on August 4. In the south cut there was no trouble with frost because the top 'muck' had been ground-sluiced; in the area covered by the north open-cut the grade was too flat for sluicing; hence the occasional patches of ice. Steam is made by burning wood at $15 per cord delivered. The two 50-hp. boilers cost $2200 apiece delivered. The two scraper-engines cost $1500 each. Board for the men costs the operators $3 per day, even when buying provisions on a good scale. The ground is being worked on a 50%

lay, for 3 years. John Webster is in charge, for D. G. Aitken, who is lessee from Frank G. Manley.

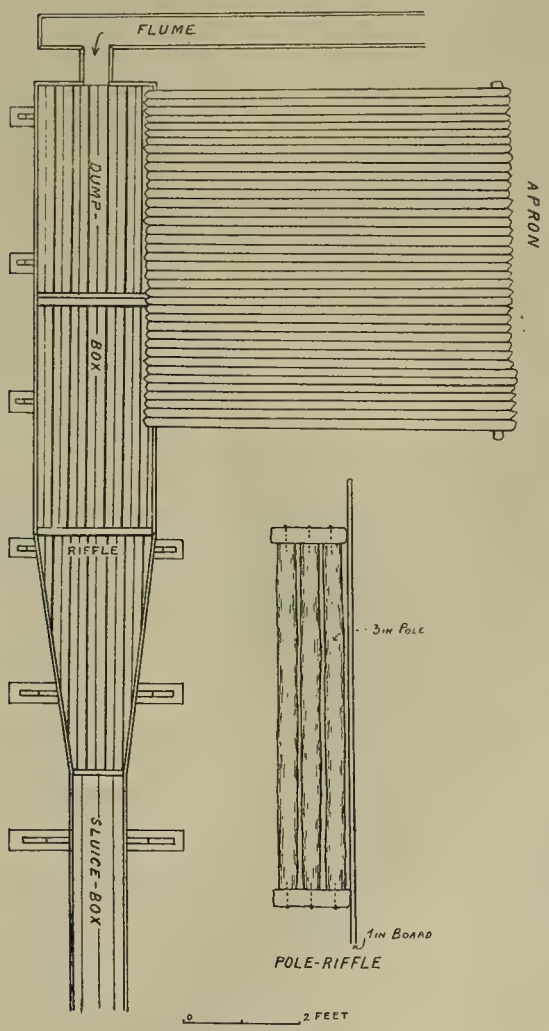


Dump-Box and Sluices.



Hungarian Riffles.

After C. W. Purington.



Sketch of Gold-Saving Apparatus.

noon hour, while the men are taking the mid-day meal, is devoted to this purpose by the chief operators. The owner of the claim is usually represented and this representative assists. The accompanying sketch illustrates the dump-box and the sluice-boxes. The top box is 4 ft. wide and 24 ft. long; the sluice-boxes that follow are 16 in. wide. Of the latter there are 7. When operations start, only 4 sluice-boxes are placed in position, but as additional space



Sluice-Boxes, Showing Riffles. The Pan Holds the Gold From the Clean-Up.

While on Cleary creek, I was present at one of the 'clean-ups' on the Discovery claim. The gold is gathered for shipment every 4 days or 8 shifts. The

is required for disposal of the tailing, more sluice-boxes are added from time to time. Each is 12 ft. long; therefore the total length of this gold-saving machine is 108 ft. When the bucket is discharged, the gravel falls upon the apron of the dump-box. This apron is inclined at 50° and is built of 3-in. poles nailed close together. The gold-bearing material slides into the dump-box and is washed down the sluices by the water issuing from a gate in a flume. The gold is arrested by riffles. These consist of poles, 3 in. diam. and 6 ft. long, 1 to 1½ in. apart, nailed to two 14-in. cross-bars. They are laid lengthwise along the bottom of the sluice-boxes and are held in position by a 1-in. board on each side. The poles become worn on top and are replaced at alternate clean-ups, that is, after an interval of 8 days. When preparing to clean-up, most of the water is shut off. The gold can be seen readily, especially at the upper end. Picks are used to pry the side boards and loosen the riffle-frames. They are lifted to one side, being usually laid on the edge of the trestle that carries the sluice-boxes. A pick is driven into the apron so as to hold the first four riffle-frames, which are thus put out of the way. First, however, these and the other riffles are washed in the small stream of water still running down the sluices. Then the compact sediment lying on the bottom of the dump-box and on the first four sluice-boxes is shoveled until it is loose, preparatory to being put into iron buckets, which are carried to the head of the dump-box and there emptied so as to make a heap aggregating a little more than half a cubic yard. Then the washing begins. Water is turned on—about half a sluice-head of about 50 cu. ft. per minute. A wooden bar, 3 in. deep, is placed across the third sluice-box so as to check the descent of the tailing. One man stands at the head of the dump-box and shovels the golden sediment as the water runs past and at the same time the four other men check the flow with shovels and paddles so as to work it up toward the head, all the time separating the light and valueless sand from the heavy rich particles of gold. This concentrating process proceeds until complete. The water is turned off and the gold is seen lying on the bottom of the sluice-boxes in glorious heaps. Then whisk-brooms are employed to wash the gold to the head of the dump-box, the little water still running sufficing to remove the black sand and other small heavy impurities. The gold is shoveled into a pan. It looked like a heap of saw-dust or bran. On lifting the riffle-frames the bottom looked like a golden mosaic. Several nuggets—the largest 1½ oz.—were found fully 30 ft. from the head of the dump-box. It is supposed that nuggets will roll down the pole-riffles, therefore a series of block-riffles, followed by Hungarian riffles, is placed below the others. To anyone accustomed to stamp-mills, the handling of the gold looked rather careless and the chance for catching fine gold seemed slight. The operation ended with a pan full of gold and a bucket full of a rich sandy concentrate. Both were re-washed in a separate sluice-box, 10 in. wide and 12 ft. long, using a whisk-broom to move the gold from side to side in a current of clean water. Two bar-riffles served to arrest any that might otherwise escape. The cleaned gold is worth $16.90 per oz. Impurities consist of rounded crystals of garnet and specks of both hematite and magnetite. This clean-up yielded $14,000. Two men spend the larger part of an afternoon in eliminating impurities that could be slagged in a crucible within a few minutes. The explanation is that the operators dislike to put themselves in the power of the bank to which they sell the gold; if they clean the gold themselves, they know its true weight, and they avoid extra charges for refining.

Another example of the open-cut method was observed at No. 3½ Above Discovery on Ophir creek, on the Seward Peninsula. The creek itself had been diverted. The ground is in a naturally thawed condition. Under the overburden of sand, the gravel is 4 ft. thick and is first excavated; then a second slice removes the bedrock to an additional depth of 4 ft. The bedrock is shaley limestone, with an irregular surface favorable to the concentration of gold. The ground is broken with the pick and the material thus released is shoveled into buckets, hauled and hoisted by derrick. The few large (more than 12 in.) stones or boulders are stacked in the centre of the excavation. A steam-derrick and 8 buckets are in use. There is a pair of men to each bucket. When it is full, the small cable from the derrick pulls the bucket along skids to a point immediately under the end of the boom, whence it is hoisted to the dump-box. The arrangement is closely similar to that described by Mr. Purington, who visited this locality four years ago. I have borrowed the sketch appearing in his account,* which is excellent. The buckets are made from drums that formerly contained oil (110 gal.); these drums have been cut down 8 in., and from the original hoop a bail has been made; this is attached so far below the centre as to cause the bucket to tip easily. Each bucket holds 11 cu. ft., being 2 ft. 8 in. high and 2 ft. 5 in. diam. One of these is discharged at the dump-box each minute. This equals 300 cubic yards per 24 hours, working a total of 42 men in two shifts. One man attends to the guy-rope and pulls the lever that upsets the bucket at the upper terminal; another attaches the hook in the mine. Drainage is effected by a hydraulic lift, by a China pump, and by a centrifugal pump, the three machines constituting a curious medley of mechanical contrivances. The man at the dump-box was not forking out any boulders—a sign of small gravel and plenty of water. The sluice-boxes are 26 in. wide. The dump-box has no apron. The yield is estimated at $3 to $4 per cubic yard. But even this return does not mean a fortune, for the royalty to the owner is 50% of the gross, and the cost is $1 to $1.20 per cubic yard. The profit is only 50 to 75 cents per yard during a season of 4 months. This is a good example of the mining operations that enrich idle owners who allow adventurous lay-men to assume the risk of operation. The result is to work the ground rapidly and extrava-

*'Gravel and Placer Mining in Alaska.' By C. W. Purington. U. S. G. S. Bulletin 263, p. 70.

gantly, leaving piles of tailing that will be worked again a year or two hence.

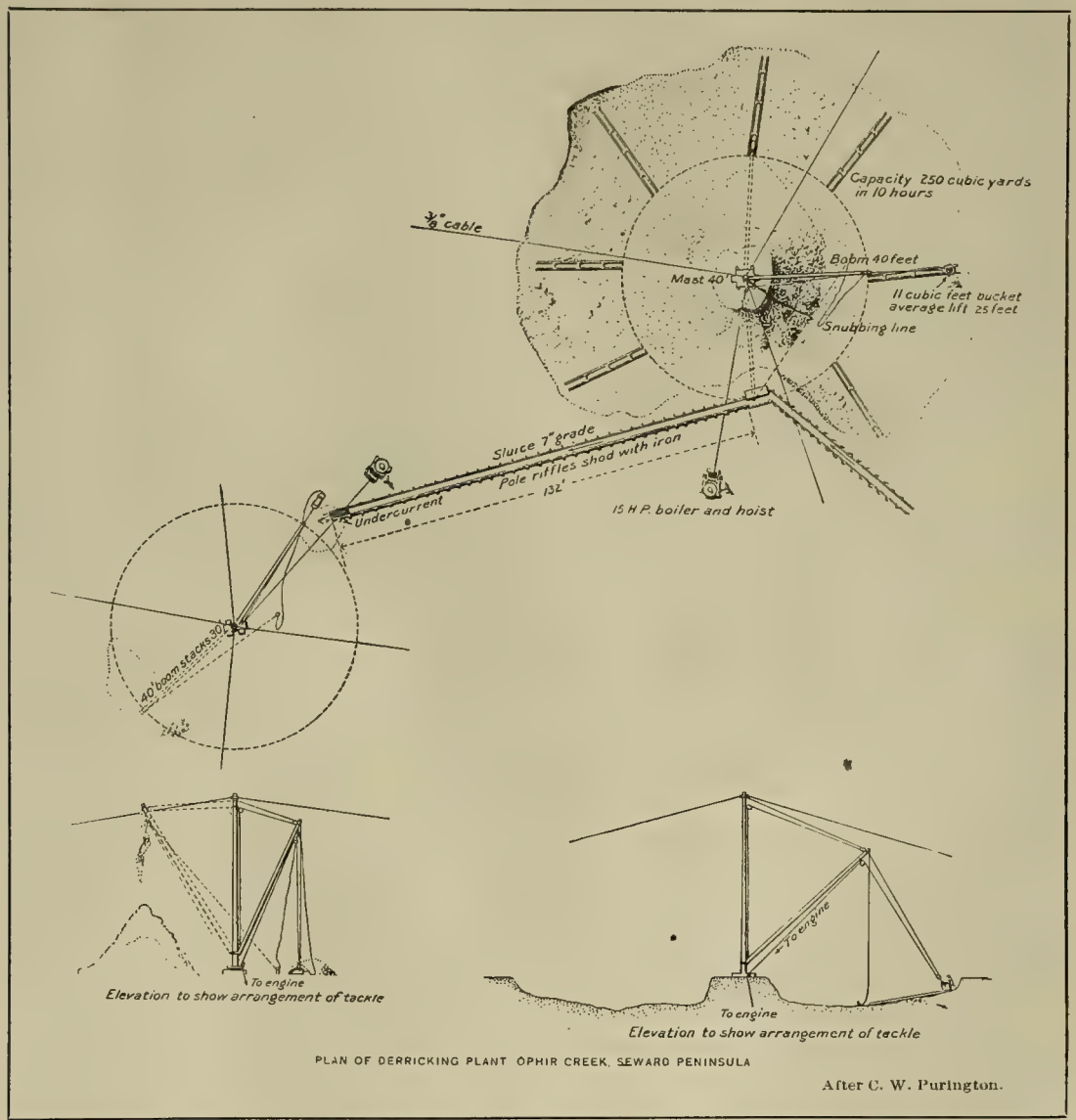
As claims were consolidated and capital was placed at the disposal of operators, the tendency was to enlarge the plan of operations. Ditches were built and a plentiful supply of water was brought into service. This rendered possible the employment of the hydraulic elevator, a machine consisting of an iron pipe, placed at a steep angle, so that the gravel is propelled to a higher level by means of a jet of water under heavy pressure. The material to be elevated is washed into the pit or receptacle at the foot of the elevator by means of a monitor or nozzle, emitting a powerful stream of water at high velocity.

The direct application of hydraulic mining was not possible in the creeks because of the lack of grade. Hydraulic mining is only practicable where the bedrock is steep and there is plenty of room for the discharge of the tailing; therefore it is confined to benches on hillsides or to the banks of creeks so situated as to give ample grade.

Where the gravel deposit was too shallow for ground-sluicing, yet not deep enough for drift-mining, where water was not available for hydraulic elevating, and where the ground was thawed, the dredge was employed to dig the alluvium. Thus another chapter was added to the development of mining in the North.

Finally, where the gravel lay on a bedrock unsuitable for dredging, especially in old creek diggings, where virgin ground, tailing heaps, old timbers, and other varying conditions were unfavorable to the methods already described, a combination was effected between dredging and hydraulic mining, and thus the mechanical elevator came into existence.

It is the story of the empirical development of mining methods and the imperial conquest of man over a wide domain of gold-bearing territory. Many contributed to the invention of new devices and even the most inventive gained from the stimulus of comradeship. The haste to become rich impelled most of the operators, but the ambition to do a thing well was a motive power to others. Nor is the evolution complete. It is still in progress.



PLAN OF DERRICKING PLANT ÖPHIR CREEK, SEWARD PENINSULA

After C. W. Purington.

COSTS OF LAKE SUPERIOR SMELTING.

Written for the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN.

Of the stock of this company, consisting of 48,000 shares, the Osceola owns 15,000, the Tamarack 25,000, and the Isle Royale 8000 shares.

These small works, treating something over 3000 tons monthly, have four furnaces in operation on concentrate from the Isle Royale, Osceola, Tamarack, and Ahmeek mines. The company formerly treated concentrate from the Atlantic, Wolverine, and Mohawk mines, as well as that from certain South-Range mines, notably the Champion, Baltic, and Trimountain. To the concentrate from the above-named mines there is added, to the extent of 50%, cathodes from the refinery of the Boston & Montana Co. at Great Falls, Montana. The product has been sold as Lake copper by the United Metals Selling Co. of New York, a company which has the sale of over 600 million pounds of copper annually out of the one billion produced in the United States. The product, arising from the mixture of the concentrate of any mine with these cathodes, is sold under the name of that particular mine, except that the Ahmeek goes into the molds of the Osceola brand.

The following table gives the output of the works for the years 1902 to 1906, inclusive:

Mine.	1902.	1903.	1904.	1905.	1906.
Tamarack	1,483,888	24,105,397	20,643,982	24,924,001	17,492,592
Osceola	.....	18,351,531	28,707,914	30,455,359	32,853,213
Ahmeek	.....	.....	416,167	2,548,106	5,180,293
N.E.C.&M.A.	.....	.....	8,231,734	None.	None.
	1,483,888	42,456,928	57,999,797	57,927,466	55,526,088

Of the total copper produced under these names there was used of B. & M. cathodes the following quantities:

Mine.	1902.	1903.	1904.	1905.	1906.
Tamarack	845,953	11,408,778	8,853,278	12,466,285	9,650,594
Osceola	.....	7,660,333	12,365,769	14,031,462	16,072,027
Ahmeek	.....	.....	135,150	1,211,435	2,508,838
N.E.C.&M.A.	.....	.....	6,616,683	None.	None.
	845,953	19,069,111	27,970,880	27,709,182	28,231,459
	57%	45%	48%	48%	51%

Taking the year 1906, the monthly production of the mines concerned, not counting cathodes, was approximately:

	Lb.
Tamarack	800,000
Osceola	1,000,000
Isle Royale	200,000
Ahmeek	300,000
Monthly production	2,100,000

The concentrate, locally called 'mineral', from the Isle Royale was separately smelted and made into anodes, which were sent East to be treated at the Raritan works, Raritan, N. J. This copper was marketed as I. R. M. The Western, or B. & M., cathodes were treated at a charge of $4 per ton, crediting the shippers with 99.8% of the weight as copper. Of the total of copper put into the reverberatory furnace, 12% goes into the slag produced in the melting, and this slag will contain 20% copper. The slag is afterward treated in a blast-furnace for the recovery of this copper, which is later again refined.

Referring particularly to the Osceola copper, this is made into wire-bars or cakes as desired, being refined until by test the copper has a conductivity of 98.5 to 100.6% when made into annealed wire-bars, or of 97.5 to 99% when made into ingots. The Western, or B. & M., anodes contain no more than 0.0024 to 0.0048% arsenic, and have a conductivity of 101.5 per cent.

Smelting Costs.—In the year ending April 30, 1906, there was smelted 41,176.88 tons of 'mineral', including 18.36 tons briquetted and smelted in the blast-furnace. This produced 12,515.34 tons of slag yielding 5374.81 tons of 'cupola blocks' of perhaps 95% Cu. These blocks were re-melted and refined in the reverberatories, so that the total material treated by the latter was 46,551.69 short tons, containing 55,526,088 lb. copper, or nearly 60% of the concentrate.

The summary of costs shows:

Items of expense.	For year.	Per ton of concentrate.
Reverberatory—Operating	$195,144.61	$4.741
Miscellaneous	43,408.84	1.055
Construction	15,664.74	0.380
Blast-furnace—Operating	32,623.44	0.790
Miscellaneous	13,460.59	0.327
	$300,302.21	$7.293

The total blast-furnace expense per ton of slag is $3.682. The most interesting cost-figures are those given in connection with the operation of the plant for April 1906. They are as follows: 'Mineral', including cathodes, smelted in reverberatories:

	Tons.	
Tamarack	537.24	
Osceola	1,109.43	
Ahmeek	113.16	
Isle Royale	172.94	
Boston & Montana cathodes	1,101.88	
		3,034.66
Cupola blocks		146.76
		3,181.42

Slag smelted in blast-furnaces:

	Tons.
From Tamarack concentrate	319.09
Osceola concentrate	343.09
Ahmeek concentrate	41.74

COSTS IN APRIL, 1906.

	For the month.		Per ton of 'mineral.'
Reverberatory expense—			
Operating:			
Labor	$5,991.82		
Supplies, including fuel	4,728.51		
Power	329.69		
Repairs	1,598.71		
		$12,648.73	$4.168
Other expense:			
Labor	986.33		
Miscellaneous (distributed)	1,899.30		
		2,885.63	0.951
Construction		2,713.04	0.893
		18,247.40	6.012
Blast-furnace expense—			
Operating:			
Labor	495.05		
Supplies, including fuel	1,476.54		
Power	242.22		
		2,215.81	0.737
Other expense:			
Labor	612.55		
Miscellaneous (distributed)	474.82		
		1,087.37	0.358
		$3,303.18	$1.089

The miscellaneous expense, distributed, is as follows:

Labor (yard and office)	$1,119.85	
Office supplies	98.02	
General expense*	1,156.18	
Heating	218.74	
Teaming	644.72	
Miscellaneous supplies	184.68	
		$3,312.26

*This includes cleaning yard, telegrams, express, telephone, electric lighting, proportion of general office expense, taxes, insurance, and share of engine expense.

Summary of costs for April 1906 shows reverberatory expense and construction, $18,247.40; blast-furnace expense, $3293.18; being a total of $21,640.58, or $7.101 per ton of concentrate. Miscellaneous expense has been distributed to the reverberatory and blast-furnace expense, and so does not appear in the summary. In the cupola or blast-furnace was smelted 776.47 tons of slag at an expense of $3293.18, or $4.241 per ton. Recapitulating, the furnace-expenses and construction show:

	Costs.	Per cent of total.
Reverberatory	$15,534.36	72.08
Blast-furnace	3,303.18	15.33
Construction	2,713.04	12.59
		100.00

The smelting charges to cover expenses were:

Tamarack, 537.24 tons 'mineral' at	$7.16	$ 3,846.64
20(?) ingot barrels at	1.00	20.00
Osceola, 1109.43 tons 'mineral' at	8.75	9,707.51
Ahmeek, 113.16 tons 'mineral' at	8.75	990.15
Isle Royale, 172.94 tons 'mineral' at	7.16	1,238.25
24 ingot barrels at	1.00	24.00
L. & M. cathodes, 1101.88 barrels at	4.00	4,403.52
Total smelting charges for the month		$20,230.07

The succeeding items of costs will be useful in enabling comparisons to be made:

Bituminous furnace coal, per ton unloaded	$5.10
Bituminous boiler coal, per ton unloaded	3.15
Anthracite, per ton unloaded	5.65
Coke, per ton unloaded	6.90
Limestone, per ton unloaded	1.40
Iron ore, per ton unloaded	4.10
Poles, per cord delivered	3.42
Charcoal, per bushel	0.13
Labor, per day, refining	2.66
Surface labor, per day	2.11
Mechanics, per day	3.12
Team and driver, per day	2.66
Labor, handling copper, per day	2.48
Foreman, per day	6.00
Inspector, $125 per month, per day	4.80
Weighers, $70 per month, per day	2.70
Blast-furnace, inside labor, per day	2.11
Blast-furnace foreman, per day	5.00
Clerk, $138.50 per month, per day	5.77
Shipper, $75 per month, per day	2.90
Stenographer, $80 per month, per day	3.08
Assayers, per day	3.30
Cooper, per day	2.50

The fuel used in the blast-furnace constitutes 19.4% of the slag, or 15.0% of the charge, being about in the proportion of one third anthracite to two thirds coke. Of the total charge of 1002.44 tons smelted, about 18% was limestone and 4.3 iron ore, which shows the infusible nature of the reverberatory slag. The item of 6 days for foreman would indicate that number of running days for the furnace, or an output of 166 tons of charge daily, using 15 men per shift. The fuel-cost was 98c. per ton of charge, and labor was half that, or 49c. per ton. Iron, steel, and other supplies will be estimated at 3% of the total blast-furnace expense. In preparing for the run, $137 was expended in getting the blast-furnace ready, while for delivering charge and fuel to the furnace, repairing tram-cars, and removing waste slag, the cost was $527, or 26c. per ton. The operating costs for the blast-furnace seem excessive.

The coal used in the reverberatory furnace was 32% of the charge smelted; 10 poles, or two thirds of a cord, and 15 bushels of charcoal were used per charge, and each furnace would need 14 to 16 men per 24 hr. The miscellaneous supplies, such as slag, sand, lime, castings, iron and steel, tools, etc., amount to 8.5% of the total reverberatory expense, exclusive of new construction, that item being 12.6% of the total, as already specified.

The miscellaneous expense constituted 15% of the total charge against the plant, and such a proportionately large amount must be spent by each of the five smelting works now treating Lake copper. A plant for the treatment of the Lake 'mineral', both by electrolysis and by reverberatory smelting, would naturally be situated at Buffalo. Use could be made of water-freight to ship in the open season, and it would go by rail in winter. The lower-grade concentrate, containing about 20%, could be briquetted and smelted near the mines by a blast-furnace, and the copper shipped to Buffalo.

Dynamite of any given grade will develop differing degrees of explosive energy in accordance with the force of the original detonation communicated to it by the cap used. In other words a 5X cap will develop greater disruptive force in the powder than a 3X cap. The reason for this is primarily that the 'combustion' is more perfect, the amount of CO_2 produced being greater in proportion to the CO than when the detonation is weak. That means the development of a higher temperature in the gases of combustion, augmenting their expansive power. Moreover, the velocity of the detonating wave varies as the force of the impact occasioned by the explosion of the cap, which means that the entire charge is gasified more nearly instantaneously, thus avoiding loss of energy through expansion of the gases into cracks produced in the rocks as a result of the relatively slow combustion during the explosion of a charge under a weak detonating impulse.

Abolition of metal gauges is being urged in a vigorous campaign by the Association of American Steel Manufacturers. They hope to induce manufacturers and users of materials commonly described by a gauge-number hereafter to designate sheets, wire, rods, tubing, hoops, and the like by thicknesses in decimal parts of an inch instead of by gauge-number. This change is not intended to apply to finished articles, such as screws, nails, rivets, or to manufactured articles known to the trade by size numbers. The Westinghouse Electric & Mfg. Co. has been following this practice for five years, and with the adoption of decimal designations they were enabled to dispense with ten or more different gauge systems formerly used.

NEVADA STATUTE FOR PROTECTION OF INVESTORS.

Nevada has taken an important step toward the protection of investors by the enactment of the Kendall bill, which requires all mining companies to mail to stockholders, and to file in the office of the County Recorder, each June and November, a statement showing:

(a) The name of each mining claim and the total number of such claims or fractions thereof owned or leased, and the number thereof being worked or developed, also the county and mining district (if there be one) wherein said claims are located, and the nearest postoffice and the distance therefrom, as near as can be ascertained.

(b) The nature of the title thereof, or interest therein, whether leasehold or otherwise, also the date each claim or interest therein was purchased, leased, or otherwise acquired by such corporation.

(c) The character, value, and a general description of all buildings, works, machinery, and other improvements on each unpatented claim, and the character, value, and a general description of all buildings, works, machinery, and other improvements being actually used or operated by such corporation on its patented ground, taken as a whole.

(d) The total number of days labor employed and expended in actually developing the mineral resources of each unpatented mining claim, if any, and of the entire patented property, if any, during the six months next preceding, and the total sum of money, or other valuable consideration, given or paid out therefor.

(e) The total number of shares such corporation is by law authorized to issue and the different classes and par value thereof.

(f) The total number of shares of stock originally set aside by such corporation, if any, in its treasury or otherwise, to sell or otherwise dispose of for the purpose of working, developing, or otherwise improving any patented or unpatented mining claim, or claims, owned or leased or being worked or developed by such corporation, and the total amount of money realized from the sale of any portion thereof during the six months next preceding.

(g) The total number of shares of treasury stock sold, the price thereof per share, and the total sum of money or other consideration received therefor during the six months next preceding the date of filing of the statement herein required, and the number of shares of treasury stock remaining unsold at said time.

(h) The amount of money, if any, actually paid by such corporation to each of its officers, superintendents, or to other persons, as salary or compensation for services rendered such corporation, stating the nature of such services; also, the respective amounts, if any, expended for advertising and as commisions for sales of stock, during the six months next preceding the filing of said statement.

(i) The total amount of bullion tax paid during the six months next preceding.

It is further made unlawful for any corporation, officer, agent, or director to issue stock or to sell or offer for sale any certificate upon which is not stamped or printed in English letters or characters at least one half inch high, the words 'Treasury Stock', or 'Promotion Stock', as the case may be. Treasury stock is defined as "stocks or shares that have been or shall be specifically set aside to sell for money, or other valuable consideration, and the proceeds of which are to be used for the actual development of the mineral resources of any mining claim or for the purpose of making necessary improvements thereon," while "all other stock of such corporation is defined as promotion stock." Penalties of fine or imprisonment are provided for violation of the act, and resident agents are made responsible for the acts of foreign companies.

PERILS OF A PROFESSOR.

Our readers are aware that when any earthquake or other unexpected occurrence happens, in fact, anything that can be labeled a geological phenomenon, it is usual for the gentlemen of the daily press to seek an interview with scientific men qualified to express authoritative opinions. The scribes of the press call them 'savants', but they survive even that. Then they publish a distorted report of what has been said, and the compositor heightens the mystery of the performance by interpolating a few typographical errors. The result is impressive but unsatisfactory. Every time a seismic ruction happens the reporters in New York rush to Morningside Heights and interview our distinguished friend Mr. Kemp, the professor of geology in Columbia University. He is both good natured and brave, so he meets the bombardment of questions and does his best to illuminate a dark world. But the ingratitude of mankind is proverbial; therefore such epistles as the annexed:

January 12th, 1909.

Dr. James F. Kemp,
New York City, N. Y.

Dear Sir:—

I read your opinion on the Sicily earthquake in the Kansas City Star. That you are a natural born fool is not what I wish to say, but that your argument lacks common sense would come nearer to the point. You say the earth is contracting. Stop and think. What would contract a melted earth, heat or cold? How can the inside shrink faster than the outside? Which would cool off faster, the inside or the outside? Volcanoes have volcanic ash, showing that something has been burned up. How can combustibles pass through regions hotter than eternal torments to be burned up afterwards by volcanoes? What is the earth doing, cooling off or warming up? It is taught in the schools latitude about 42 was covered with fields of ice not many thousand years ago. You know that that ice is not there today. How can that ice disappear with the earth cooling? If you give it up, I would like to hear from you. If you are willing to learn, I am willing to teach.

Resp. yours,
(Signed) J. R. Snelling,
Blanchard, Louisiana.

COMPANY REPORTS.

BROKEN HILL SOUTH SILVER MINING COMPANY.

The report of this company for the half-year ending December 31, 1908, shows 112,288 tons of ore raised, yielding 16.2% Pb, 5.6 oz. Ag, 12.1% Zn. Of this 16.9% came from the lowest, 970-ft., level, 50.5 from the 825, and 23.4 from the 725-ft. levels, respectively. Ore was milled at the rate of 4252 tons per week, as against 3031 for the previous half-year, and it is stated that the new mill has disappointed critics and vindicated the estimates of W. E. Wainwright, the manager. Mining costs for the period are given at 9s. 3.3d., compared with 13s. 4.7d. for the corresponding period of the preceding year. Milling costs were 14s. 2.8d. and 21s. 4.8d., while 5.2d. and 3.04d. was spent in developing during the periods compared. A portion of the tailing is being used for stope-filling, this accounting for 11.1d. of the mining cost already given. American zinc and lead producers will be interested in the estimated tonnage of accumulated tailing and slime. This shows: Old mill-tailing, 1,078,743 tons, carrying 6% Pb, 3.7 oz. Ag, 16.7% Zn; new mill-tailing, 33,039, with 4.3%, 3.4 oz., and 18.7%; and slime, 158,636, with 12, 6, and 16.3, respectively. No dividend was paid during the period covered by the report, but £20,000 was distributed in January. M. E. Greene, chairman of the board, makes the following statement regarding information given to stockholders: "Since the formation of the company it has been the practice to issue half-yearly accounts and reports, and to give the press weekly statements. The directors disclaim any desire to keep from the shareholders any information; in fact, they know of no company whose reports and accounts are more full and complete. If quarterly reports or any specific information are desired, the directors will cheerfully supply the same."

STRATTON'S INDEPENDENCE.

This famous mine, at Cripple Creek, Colorado, has seen its best days. According to the report for the year 1908 the output was 5778 tons having a gross value of $163,179. This was mined by lessees, who paid a royalty of 36%. The total receipts from such royalties were $41,492. In 1907 the gross output was $602,464, the great falling off being due to the exhaustion of the known deposits of high-grade ore. A flat royalty of 20% is now exacted on all ore mined, and this new arrangement has proved satisfactory, encouraging tributers to mine the low-grade stuff. The new mill to treat the old dumps has been started. Philip Argall is consulting engineer.

MYSORE.

From the report of the Mysore Gold Mining Co. for the year 1908 it is apparent that this great mine is doing well. The mine is in the Kolar district of India, the company is English, the management is in the experienced hands of John Taylor & Sons.

In 1898 the output was 206,170 tons, yielding 191,766 oz., or an average of 18 dwt. 14 gr. per ton. In addition, 184,643 tons of tailing were treated by cyanidation, the yield being 24,722 oz., or 2 dwt. 16 gr. per ton. Thus the total recovery was 216,488 oz. of bar gold worth £848,145. The expenditure was £351,902. After payment of royalty, the profit was £458,285. Thus the results were the best on record. The dividends for the year amount to £350,055. As compared with 1907 the tonnage of ore treated is greater by 11,332, and of tailing by 17,114; the gold won has increased by 7047 oz., equal to £28,031; the expenditure is £5694 less, and the profit is £29,229 more.

The mine has reached a depth of 3908 ft. below the surface. At 3845 ft. a cross-cut intersected the lode, and drifts proved it to be 3 ft. wide, averaging 1 oz. 14 dwt. per ton on one side and 2½ ft. averaging 1 oz. 3 dwt. on the other. The lode continues strong and rich at each succeeding level. On December 31, 1907, the reserves were computed at 904,139 tons; on December 31, 1908, the tonnage in reserve is estimated at 969,920, so that the exploratory work has added to the life of the mine in a most satisfactory manner. Arthur Gifford is the superintendent.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

ENTRY OF COAL LANDS—CRIMINAL CONSPIRACY.

The Statutes of the United States make criminal a conspiracy to obtain title to public coal lands with the purpose of defrauding the United States in any manner or for any purpose.

United States *v.* Keitel, 29 Sup. Ct., 123, Oct. '08.

ENTRY OF COAL LANDS—EXCESSIVE AMOUNT.

Persons entitled under the United States Statute to a preferential right of entry of coal lands are prohibited from making more than one entry by the same person and from entering such lands apparently for themselves, but in fact as agent for another who has already purchased the full quantity permitted by law.

United States *v.* Forrester, 29 Sup. Ct., 132, Oct. '08.

MINING PARTNERSHIP—LIABILITY OF RETIRING PARTNER.

A mining partnership, unlike an ordinary one, is not dissolved by the sale of the interest of one of the partners; but it does not follow, from the mere continuance of the partnership, that the partner selling his interest continues liable for all of the debts of the partnership subsequently incurred. Under certain circumstances he may continue liable for a subsequently incurred indebtedness of the firm. Thus, where the partnership was indebted to laborers for work done while the selling partner was still a member of the firm, and the laborers continue their work upon the property without notice of the sale of the partner's interest, the retiring partner will continue to be liable. The rule is that the liability of a general partner for the acts of his co-partners continues, after dissolution of the partnership, in favor of persons who have had dealings with and given credit to the partnership until they receive notice of the dissolution. But a retiring partner is not liable for the wages of miners after the sale of his interest where they have notice of such sale; neither is he liable for the wages of miners subsequently employed, and who had no knowledge of his connection with the partnership.

Kelley *v.* McNamee, 164 Fed. 369, Oct., '08.

MINING CLAIM OWNED BY CORPORATION—ASSESSMENT WORK BY STOCKHOLDERS.

Stockholders of a corporation have such a beneficial interest in the corporate property that mining work done by them on unpatented claims of the corporation must be counted as representative work; and if the work so done by them is sufficient in amount and performed within the time, it will prevent a forfeiture of the claim.

Wailes *v.* Davies, 164 Fed. 397, Oct., '08.

INSPECTION OF MINES—DUTY OF OWNER.

The extent of the responsibility of a mine owner in regard to the inspection of mines for the benefit of licensees, depends upon the nature of the premises and the character of the work required. The frequency with which inspection should be made cannot be determined as a matter of law, but is a question of fact to be determined by the jury on the trial of the case.

Tennessee Coal, Iron & Railroad Co. *v.* Burgess, (Ala.) 47 South. 1029, Dec., '08.

GAS LEASE—METHOD OF SURRENDER.

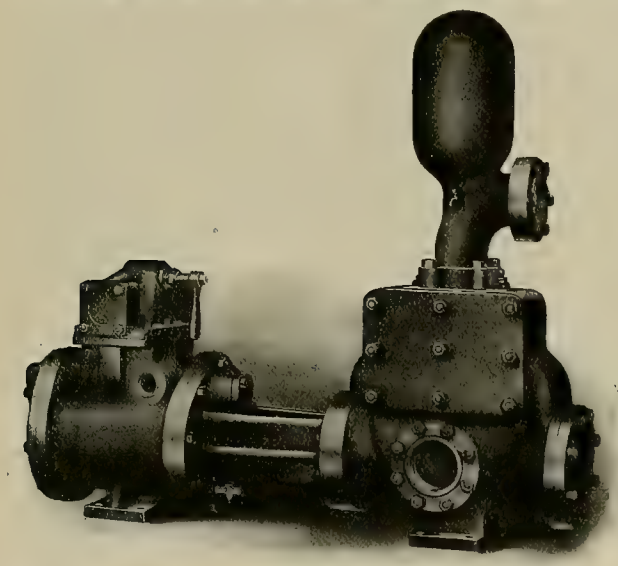
The surrender of an unrecorded mining lease need not be in writing. Any notice is sufficient that definitely informs the lessor that the lease has been surrendered; but the original lease should be re-delivered to the lessor or destroyed. A recorded mining lease can only be surrendered by an entry duly made and acknowledged on the margin of the record, or by an instrument signed and acknowledged by the lessee.

Ward *v.* Triple State Natural Gas & Oil Co., (Ky.) 115 Southwest. 819, Jan., '09.

Single Horizontal Piston-Pressure Pump.

The accompanying engraving shows the salient features of a pump just put on the market to meet the demand for a machine of moderate cost and simple construction, which will stand the wear and tear of rough usage, and which at the same time can be operated without skilled attention. It is a strong plain pump, designed particularly to overcome the objectionable features common to most pumps of its class. It is thoroughly adapted for rough mining service, for contractors' use, for boiler-feeding, or for any pressure-work up to 200 lb. per square inch working water-pressure.

The valve gear is wholly enclosed, and there are no exposed working-parts that can be tampered with, or become broken by accident. The pump can be put into unskilled hands, will stand abuse and neglect, and keep on doing its work without giving trouble. Suction openings are cast on both sides of the pump-cylinder, and the discharge-outlet can be faced in four different directions for convenience in making pipe-connections. The steam and water-cylinders can be turned end for end on the centre-piece connection so as to bring the hand-holes and pipe-connections into the most accessible position when the pump is used in cramped situations. All of the water-valves and valve-seats are securely locked into place, so that they cannot get adrift under any conditions, and at the same time they can be quickly removed for inspection or replacement. Great care has been taken to make this pump applicable to the varied conditions demanded by miners and contractors. These pumps are denominated 'Type M.' They are in a great variety of sizes, and prompt shipment can be made by the manufacturers, the Blake & Knowles Steam Pump Works of New York and Boston.



Catalogues Received.

The Cyclone Drill Co., Orrville, Ohio, has just issued a folder illustrating a number of standard outfits for well machines, prospecting, and the like.

The W. S. Rockwell Co., New York, is distributing a small pamphlet which comprehensively describes the Rockwell rotary annealing and hardening furnace.

The Williams Gauge Co., Pittsburg, Pa., has just issued a 16-page booklet on the economic operation of steam power plants, which it will send to anyone interested.

The Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y., has just issued two small pamphlets, No. 13 and 14, the former on magneto telephones for train dispatching and the latter on its compact type magneto wall telephones.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the Mining and Scientific Press.

The Gas Engine. By Cecil P. Poole. 8vo., pp. 97, Ill., Index. New York. Hill Publishing Co. 1909. Price $1.

As a ready assistant, quite different in character from the more elaborate treatise of Forrest R. Jones, is this little volume, which undertakes to cover much the same ground in a condensed form and in a more empirical manner. It contains a most useful chapter on pressure, temperature, and output calculations, with formulae, supplemented by elaborate tables of expansion-ratios, piston-displacement, values of certain constants, and so forth. The work has its own special importance in the field indicated.

Contributions to the Tertiary Paleontology of the Pacific Coast. I. The Miocene of Astoria and Coos Bay, Oregon. By W. H. Dall, U. S. Ceol. Sur., Prof. Pap. 59. 4to., pp. 279, 22 fig.

Bibliography of North American Geology for 1906 and 1907, being Bulletin No. 372 of the U. S. G. S. By F. B. weeks and J. M. Nickles. Obtainable free of charge from the Survey office, Washington, D. C.

Proceedings of the American Mining Congress. Eleventh annual session, Pittsburg, Pa., Dec. 2-5, 1908. 8vo. 122 and 268 pages.

Commercial Paragraphs.

The Denver Fire Clay Co., Denver, announces that it is agent for the American Smelting & Refining Co.'s litharge and test lead.

F. W. Bostwick has recently been appointed general western agent for the Norwalk Iron Works Co., and has opened an office at 611 Ideal Bdg., Denver, Colorado.

Herman Nieter, for the last two years Eastern sales agent for the Canton Boiler & Engineering Co., of Canton, Ohio, has been appointed sales manager for that company and will make his headquarters at Canton, Ohio.

The Hammond Iron Works, Warren, Pa., has recently received an order for tanks and zinc-boxes for the Aguacate Mining Co., of Costa Rica. The order includes the erection, and 24,000 ft. of 5-in. riveted steel pipe. The same firm will soon ship an order of cyanide tanks to the Carmen-Guanajuato Mining Co., of Guanajuato, Mexico.

Chalmers & Williams, Chicago, advise that they have recently received orders from the Aguacate Mines, Costa Rica, for a 100-stamp mill, including Kennedy crushers, Burt cyanide filters, and Chalmers & Williams tube-mills; and from the Lluvia de Oro Gold Mining Co., Lluvia de Oro, Mexico, for two 48 in. by 20 ft. Burt cyanide filters.

The Wood Drill Works of Paterson, N. J., has recently shipped complete drilling outfits to the following schools for use in demonstrative work and instruction, and is issuing an enlarged sectional cut of the machine for use in class work: University of Missouri, University of Colorado, University of Michigan, State University of Kentucky, and University of Washington.

The General Engineering Co., of Salt Lake City, Utah, has received orders from both the British Mexican Development Co., of Mexico City, Mexico, and from the Transvaal University College of Johannesburg, South Africa, for one of their miniature testing plants. This same company has also secured a contract for a 100-ton concentrating plant for the Bingham-New Haven Gold & Copper Mining Co., Bingham Canyon, Utah.

The Allis-Chalmers Co., Milwaukee, in its Bulletin No. 1434 describes its line of hydraulic classifiers.

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EDITORIAL.

A SIERRA MADRE club is forming at Los Angeles to bring together especially the mining and oil operators. It starts out auspiciously with Mr. Seeley W. Mudd as president.

THE MINING world has completely overlooked its interest in the tariff on jute and cotton bagging. The duty as fixed by the Payne bill will maintain the price 40 per cent higher than if these materials were placed on the free list. The industry is in the hands of a trust, only three factories in the United States making such fabric.

ELIHU ROOT has done many things for which his countrymen may be grateful. He has added to the obligation by suggesting that the fund given in his honor to Hamilton College by Mr. Andrew Carnegie be not spent on a building. Instead it is to be invested by the trustees and held, the income to be devoted to the salaries of instructors.

SEA-BORNE MAILS to the North are to be resumed May 10, when the first steamer sails from Seattle bound for Nome. The open season this year has come unusually early. We hope the ice may break up sufficiently for the *Corwin* to make a swift and uninterrupted voyage, since the coming of the ships is the best sign of spring to our friends on Seward Peninsula.

OKLAHOMA mining claims are again attracting attention, and the Land Office has been reinvestigating the matter. In the Wichita mountains there are many dikes and a few veins. Some of the latter carry small amounts of galena and copper. These, in combination with dishonest assayers and inexperienced prospectors, have led to many fair dreams, which have so far failed of embodiment.

STEWART, of Nevada, was one of the uncorrupted and incorruptible members of the Senate. At this time it is proper to recall the leading part he took in exposing the nefarious jobbery of McKenzie and Noyes at Nome in 1900. Stewart's clear exposure of that amazing affair was so thorough that, by request, it was expunged from the Congressional Record; but it fulfilled its purpose by putting an end to the anarchy in Alaska.

CONGRESS has before it a proposition to suspend assessment work on mining claims for the year 1909. This is unnecessary and unwise. The essence of the possessory title is that the holder shall show good faith by continuous working. The legal requirement of work, to the value of $100 per year on each claim, is modest. Only by holding to that can development of our territory be secured. There is no

benefit to the country from allowing areas of mineral ground to be held for speculation, and to open the way for this would be only justifiable because of a great national emergency. No such need now exists, and the proposed action is vicious.

MEXICO has discovered a new method of shielding home industry from foreign competition. By control of the railway systems through the recent merger, the Government has found it possible to apply discriminating freight rates, having the same effect as a protective tariff. By a recent executive order coal and coke entering the Republic through Laredo, Tampico, or Vera Cruz will be charged an extra peso per ton. The development of infant industry has ever awakened the demand for political nursing.

KENTUCKY is not entirely devoted to the production of tobacco, bourbon, and feuds, but has an important and imperfectly appreciated mineral production. With its large reserves of high-grade coal, its oil, fluorspar, and iron ores, it has the basis for an even larger mining industry. As the best means of developing this the State maintains an active and efficient geological survey, which has just issued a new map of the State. Mr. C. J. Norwood, Director of the Survey, is to be congratulated on its appearance.

THE ARREST of two men in Pittsburg, charged with checking baggage containing explosives, calls to mind the new law which prohibits taking explosives into any passenger or baggage car. They can now only be shipped by freight, and when prepared in accordance with the rules of the Interstate Commerce Commission. Full information must be given the railway or steamship line, and any violation of the law is punishable by fine or imprisonment. Hereafter new means must be found to balance accounts with baggage smashers.

GEOLOGICAL and topographical surveys of China were suggested last week by Mr. F. L. Cole, as a suitable gift to our neighbor from some of our benevolently inclined rich. In these days when even lakes are passed about as presents, the plan has an air of feasibility. Indeed, an excellent survey has already been made of a portion of the Empire by Mr. Bailey Willis, under the auspices of the Carnegie Institution, and Mr. T. C. Chamberlin is even now in China on behalf of the University of Chicago. These, however, are scientific surveys; the gift of the scholars of the New World to that civilization of the Old which even more than our own dignifies the status of scholar. Such fundamental studies are of international importance. They have no direct bearing on exploitation, and in financing and supporting them America is but paying back a debt we ourselves owe to Europe. To organize a systematic topographical and geological survey of a foreign country is, however, an entirely different matter, and might well be regarded as an impertinence. We may claim the privilege of studying the world-wide problems of science, just as we concede it to all, but definite plans looking to the development of a neighbor's property can only be made on invitation. We understand that Mr. R. H. Chapman of the United States Geological Survey has just been loaned to Canada to assist in the organization of topographical work, and the vigorous and far-seeing secretary of the Smithsonian Institution, Mr. C. D. Walcott, has recently recommended that as soon as funds are available, systematic scientific exploration of parts of South America be undertaken. Both of these projects appeal to us, and we wish them prompt fulfilment. We would like to see a complete survey of China, but, desirable as it is, the Chinese must themselves undertake it, with such help from others as they may invite. In the meantime there is abundant opportunity for our millionaires to assist through scientific exploration in bringing America into contact with foreign countries on a plane above that of trade and dollars.

FLUORSPAR under the new tariff is to be given protection to the extent of $1.50 per ton. This will be sufficient to confine importations to seaboard cities. At present English spar comes as far west as Pittsburg, when the market is divided with the mines of Illinois and Kentucky. West of Pittsburg there is no foreign competition. Colorado has its own supply, but such spar as is marketed elsewhere comes mainly from the Mississippi Valley. At present relatively little spar is sold, cheaper but less efficient fluxes being used. A large market is, however, possible in connection with the development of open-hearth steel-making. For this purpose an average of 5 pounds of spar per ton of steel is needed. While higher grades are preferred, and so far have mainly been supplied, material carrying 90 per cent of calcium fluoride can be used. With the reserves of bessemer ore being rapidly depleted, open-hearth steel-making is bound to increase, and with that a wider and more active market for fluorspar. A protective tariff will be particularly stimulating, and would not be an undue burden on the steel-industry. The building of the great open-hearth steel-plant at Gary will furnish an especially good market for the Illinois mines, and the whole will accentuate in some degree the tendency for the centre of steel manufacture to move westward.

Federal Coal Lands.

An important step in the revision of the Federal mining laws was taken by the last Congress in providing for the separation of surface from mineral rights in the case of certain coal lands. Heretofore land in the coalfields has been classified as either mineral or non-mineral, and patents have carried full title. The classification was for many years done by the Land Office, and unless there was an actual showing of coal or a very clear proof of its presence at shallow depth, the land was generally classified as 'non-mineral', and was sold at agricultural prices. Lands classified as 'coal-bearing' were sold at ten and twenty dollars per acre, depending on the distance from a railway line. They were often taken up at the lower rate, in advance of railway building, by people presumably having inside information.

About three years ago the classification of the public lands was undertaken by the Geological Survey,

as specifically provided by law. New surveys were made, and with the improved understanding of the stratigraphy, much land was found to be properly coal-bearing which had been taken up in good faith by agricultural claimants. In view of the fact that the prices at which coal land had been previously sold were merely minimum prices set by the law, a new schedule was prepared, under which some of the land was priced as high as $100 per acre. In situations the new price was far beyond the value of the homesteaders, whose claims were held up pending the adjustment of the matter. Congress came to the rescue by providing that such claimants might elect either to proceed to title, taking their chances on proving the non-mineral character of the ground, or they might receive title to the surface upon relinquishment of coal rights. It is provided, in event of the latter election being made, that the coal deposits under these lands shall then be subject to disposal by the United States, but that "no person shall enter upon said lands to prospect for, or to mine or remove coal therefrom, without previous consent of the owner under such patent, except upon condition as to security for and payment of all damages to such owner caused thereby." It is further provided that the owner under the patent may mine coal for his domestic use, prior to the disposal of the coal rights by the United States. The new law, by providing for separate ownership of surface and mineral rights in the same ground, opens the way to the adjustment of many difficulties. While the principle is perhaps capable of wider application as regards the public lands, it is peculiarly adapted to coal lands. It is no experiment. The great bulk of the coal mined in the United States has for many years come from land in which title to the surface and to the coal vests in different parties. This has usually resulted from sale or lease of coal rights by fee-owners who originally acquired possession under agricultural title. We have sold the surface and, usually, thrown in the minerals. The new plan gives each owner the particular thing he pays for, and this works equal justice. It is a welcome move in the direction of a more scientific utilization of our resources.

William Morris Stewart.

Another Argonaut has gone. In all that company of daring spirits that brought a vitality and power to California enriching the State more than its Golden Fleece enriched the world, none has left a more enduring mark upon his country than William Morris Stewart, the father of the Federal Mining Law. He is responsible for a departure from the time-worn customs of tenure in real estate that was revolutionary in principle and practice, and he saved the mines of the public domain from a perpetual burden that would have weakened the West and have delayed the development of our political solidarity for generations.

Stewart was born near Lyons, New York, in 1827. Attracted by tales of opportunity in the new El Dorado, he left his studies in Yale College, arriving at San Francisco in May 1850. Those were the days when a little training counted heavily. He studied law; became district attorney in 1852; and two years later was attorney general for the State. In 1860 he moved to Virginia City, Nevada, and in 1863, when barely qualified by age, he was on the floor of the National Senate. There his personality was soon strongly felt. It was no weakling who could cross swords in financial debate with so redoubtable a champion as John Sherman, and end by substituting for his cherished measure, aimed at providing revenue, a bill shorn of every feature which had led the Ohio Senator to propose the enactment of a general mining law. After the distinguished services which Stewart rendered to his country it is painful to think of the financial struggle that embittered his declining years. By a man's own skill in the warfare of life must he rise or fall. A nation seldom rewards the veterans of great battles won in legislative halls. Save for Stewart the mines of the West would have been handicapped by a royalty sufficient to extinguish the margin of profit by virtue of which a great proportion of them exist.

The first Federal mining statute was passed in 1866. The country was staggering under a stupendous debt from which the wisest could offer no certain means of escape. Commerce was conducted with depreciated currency, shifting in value from day to day; repudiation was freely talked; and credit, both national and private, was strained to its 'elastic limit'. The foremost concern was to raise revenue to meet current expenses and accruing interest on Government bonds. In such extremities it requires the faith and vision of a seer to rely on the expansion of industry to afford relief through expanding income. The readiest available resource is to increase taxes, and to levy new taxes upon existing enterprises. The most impressive contributor to wealth at that period was the golden West. The opulence of California, compared with other portions of the country, loomed cyclopean. Riches from the Western mines appeared to come easily; the average of prosperity and failure, the sheer cost of success, were overlooked. Hence the proposal to sell the mines and saddle the output with a royalty met with instant approval. It was shifting the burden of responsibility, which is a comfortable procedure for the one whose shoulders become disemburdened. Many conditions favored such a measure. The status of the mines had not yet been accurately determined. They were administered by local regulations, varying from camp to camp, but recognizing the right of location and of following the vein in depth within the longitudinal limits of the claim. Furthermore, the ownership by the United States of mineral rights in public lands, acquired by cession from Mexico, had but recently been affirmed by Mr. Justice Field in the famous case of Moore *v.* Smaw. Prior to 1861 California asserted that the minerals obtained by treaty with Mexico were held in trust by the nation for the benefit of the State as soon as admitted to the Union. If such a precedent had been established, mining throughout the Southwest would have been involved in confusion.

Bills were simultaneously introduced into the Sen-

ate and House by Sherman and Julian respectively. These were drastic fiscal measures, involving sale of the mineral lands subject to a five per cent royalty. The tactical skill of Stewart was shown in the first instance by his daring substitution of a radically different act for the Sherman bill in the Committee on Mines. Of this committee Stewart was a member. He was ably seconded in his efforts by Conness of California. The consent of the committee was secured merely in the expectation of giving the proposal an advanced affirmative standing. That it would be passed was not contemplated even by Stewart and Conness, but when the bill was reported, on June 18, 1866, they assumed an aggressive attitude, which was rendered the more effective because of the almost total ignorance of mining on the part of the other Senators. Although opposed by Williams of Oregon, and by many others, Sherman, Buckalew, and Hendricks betrayed appreciation of some of the merits of the bill. Encouraged by this small success, Stewart called the measure up ten days later, and after debate, which displayed laughable lack of geologic knowledge, it was passed. In the House, however, Julian, with the usual persistence of 'The Gentleman from Indiana', and enamored of the bill which he had drawn, acrimoniously fought the Senate measure. His first move was to seize upon it for the Committee on Public Lands, of which he was a member. There he insisted on reporting his own bill first. Meanwhile Stewart, by a canvass of the House, assured himself of a favorable disposition toward the Senate bill. Accordingly when a bill from the House relating to ditches for mining operations came into the Senate, the Stewart bill, No. 257, was attached as a 'rider'. It had then to be referred back to the House, and went on the Speaker's table. Julian made strenuous exertions to obtain the necessary majority to refer it again to committee, but failed. Thus the Stewart bill became the first Federal mining law, under the anomalous title of "An Act granting the right of way to ditch and canal owners through the public lands, and for other purposes."

The fact that Stewart was only crystallizing local usages, the operation of which he commended with more skill than their success would warrant, disarmed those who might otherwise have taken alarm at the radical concession to invade adjacent property by following the vein on its dips, angles, and spurs. The revolutionary principle of an extra-lateral right was granted with no apparent understanding of its far-reaching significance. It was done as if it were a piece of routine business—the granting of a pension, or the confirmation of a Presidential appointment. With such cool indifference was the traditional right of man in real property brushed aside by the efforts of a clever debater, fortified with a little special knowledge upon a subject which was mystery to his colleagues.

The law as passed soon displayed grave defects. No limits were set to the width of a claim, though its length was established at 200 feet, which in itself indicates the richness of the deposits worked and sought in those days when the West was young. The width of the claim, and many other matters, were left open to regulation by local mining districts. Conflicts arose over this, and over the discovery of other veins within the area granted. In 1870 Stewart proposed a revision, and the bill passed the Senate but was laid over by the House. Two years later the same bill was introduced into the House by Aaron A. Sargent of Nevada City, California, and was enacted into law. It revealed the ripened thought from longer experience of mining. The need of absolute ownership of the surface had been learned. The claim was fixed at a maximum of 1500 by 600 feet; the right to all lodes or veins apexing within the claim was granted to the locator; the Act of 1866 enabled a locator to obtain a patent to a 'mine', that of 1872 provided for patent to land; under the earlier law lode-claims were limited to those bearing gold, silver, cinnabar, and copper, the later law conceded those and 'other valuable deposits'. After an experience of six years with a mining law at variance with those of every other country on the globe, Stewart was able to defend his measure and secure confirmation of its principles by an Act merely perfecting the details. The wisdom of departing from ancient custom has been denied by able critics, while certain merits of the system have found encomiasts. It was probably a blunder, but it was determined by the exigencies of the moment. Except for the clever substitution of his bill for Sherman's, the mineral industry would have been permanently oppressed by royalties that would have impeded the development of our greatest existing copper mines, that would have made gold mining in California a mere reminiscence, that would, in short, have stunted the industrial growth of the Nation. To have abruptly altered the miners' regulations would have weaned away that adherence of the other Western members in Congress without which no mining law other than a fiscal measure could have hoped for passage in the face of a general desire to exploit the mines as a means of paying the National debt. He did the best he could, and few men could have done as well. The minerals of the West were the basis of pioneer enterprise; the mines paid for blazing the trails across the continent. To have restrained this development by odious taxation would have set back the expansion of an empire. That the shackles were not fastened upon the miner is cause to honor the name of William Morris Stewart.

COBALT ORES are being smelted at Denver at the rate of more than 1000 tons per month. So large a movement of ore away from its final market is unusual. The reason lies mainly in the falling grade of Cripple Creek ores, which sends them to the mill rather than to the smelter. The resulting shortage in silica is felt severely at the Globe plant, and it is said that enthusiasm over the arrival there of a carload of silicious ore amounts almost to a celebration. Interesting as this ore-movement is in showing the interdependence of even the international mining camps, there is none the less a deplorable economic waste involved in shipping tons of silica some thousands of miles west, in order that ounces of silver and pounds of nickel shall later go east.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. H. Weed is at Ray, Arizona.

W. F. Ferrier is in San Francisco.

A. E. Drucker is in the Kolar goldfield.

M. L. Requa has returned from New York.

Pope Yeatman is here, on his way to Mexico.

W. L. Powron is visiting mines at Quartzburg, Idaho.

David McClure has started on a holiday trip to Europe.

Richard A. Parker has returned to Denver from Arizona.

David G. Putnam, of Los Angeles, was in San Francisco.

Alan J. Fairbairn has returned to Denver from Scotland.

C. Colock Jones is at Goldfield, Nev., on professional business.

P. M. Paine, of the U. S. Land Office, has returned from Oklahoma.

Frank J. Davey, formerly of Baker City, Oregon, is now at Spokane.

C. W. Wright was married to Miss Helen Bree Dunstan at New York, April 22.

R. Gilman Brown has gone to West Africa. He will return to London in May.

J. L. Peirce, who has been in western Arizona, will return to Nome in June.

Arthur S. Eakle has returned from Germany, and is at Washington Grove, Maryland.

Benjamin B. Lawrence has been elected the first 'alumnus trustee' of Columbia University.

David Goodale has taken a position with the Trinity Gold M. & R. Co., Carrville, California.

Allen C. Redding has gone to San Luis Obispo county, California, on professional business.

E. J. Schrader, of the San Miguel G. M. Co., Sonora, has gone to St. Paul, Minnesota, for a vacation.

Percy E. Barbour has become manager of the Promontorio mines, at Minas Nuevas, Sonora, Mexico.

Norval J. Welsh, manager of the Santa Brígida mines, Chihuahua, Mexico, is at the Engineers' Club, New York.

Drummond MacGavin is on the staff of W. F. Ferrier, geologist to the U. S. S. R. & M. Co., at Mammoth, California.

H. Hughes, late of the Transvaal Gold Mine Estates, Ltd., is manager for the Ventanas Mining & Exploration Co. at Durango, Mexico.

Theodore Gross is resident manager in the United States and Mexico for the London Venture Corporation. His address is 165 Broadway, New York.

R. H. Chapman is at Ottawa, Canada, organizing topographic work for the Canadian Geological Survey. He is expected later on the Pacific Coast.

W. R. Warder, formerly of the De La Mar Gold Mines Co., in Nevada, has been appointed general manager for the Golden Star Mines Co., at Kofa, Arizona.

A. F. McCormick and P. K. Horner, formerly at the Steptoe smelter, Ely, Nevada, have gone to Katanga, Congo Free State, Africa, to take positions with W. G. Perkins, who has been appointed metallurgist for the Tanganyika Concessions, Limited.

The Pacific Coast Section of the Mining and Metallurgical Society of America met at the St. Francis Hotel on the evening of April 27. The following members and guests were present: S. B. Christy, C. W. Merrill, M. L. Requa, E. A. Hersam, W. H. Shockley, T. A. Rickard, A. C. Lawson, F. W. Bradley, H. W. Turner, George B. Starr, H. F. Bain, Edmund Juessen, Whitman Symmes, Joseph Shockley, C. W. Purington, and J. F. Newsom. The report of Mr. Requa as delegate to the New York meeting of the Society was received and discussed. Mr. Rickard resigned as local secretary and Mr. Bain was elected in his stead.

Latest Market Reports.

LOCAL METAL PRICES.
San Francisco, April 29.

Antimony	12—12¾c	Quicksilver (flask)	44—45
Electrolytic Copper	15¼—16½c	Spelter	6¼—7c
Pig Lead	4.45—5.40c	Tin	32—33½c

ANGLO-AMERICAN SHARES.
Cabled from London.

	Apr. 22. £ s. d.	Apr. 29. £ s. d.
Camp Bird	1 3 9	1 3 3
El Oro	1 4 9	1 4 4½
Esperanza	2 16 6	2 16 3
Dolores	1 5 0	1 5 0
Oroville Dredging	0 11 6	0 11 0
Mexico Mines	5 12 6	5 12 6
Tomboy	1 0 6	1 2 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.
By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 16	12.69	4.18	5.01	50⅞
" 17	12.69	4.18	5.04	51⅛
" 18	Sunday.	No market		
" 19	12 69	4.20	5.06	51⅛
" 20	12 69	4.23	5 09	51½
" 21	12 69	4.23	5.09	51⅞
" 22	12.69	4.23	5.09	51¾
" 23	12.57	4.23	5.09	52¼
" 24	12.57	4.23	5.09	52⅛
" 25	Sunday.	No market.		
" 26	12.57	4.23	5.09	52
" 27	12.57	4.23	5.07	52⅜
" 28	12.57	4.23	5.06	52⅜
" 29	12.67	4.23	5 05	52⅞

COPPER SHARES—BOSTON.

	Closing Prices. April 29.		Closing Prices. April 29.
Adventure	7⅞	Mass	10½
Ahmeek	155	Mohawk	69¾
Allouez	39	North Butte	63¾
Arcadian	4	Old Dominion	50½
Atlantic	10½	Osceola	128
Calumet & Arizona	99½	Parrot	32
Calumet & Hecla	600	Santa Fe	2
Centennial	30	Shannon	13⅞
Copper Range	76¼	Superior & Pittsburg	13⅛
Daly-West	9½	Tamarack	70
First National	5⅝	Trinity	13⅝
Franklin	15	United Copper Con	11½
Granby	98	Utah Con	38¼
Greene-Cananea, ctf	10⅜	Victoria	4½
Isle Royale	24⅝	Winona	4½
La Salle	14¼	Wolverine	143

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.
San Francisco, April 29.

Atlanta	$ 16	Midway	$ 28
Belmont	1.00	Montana Tonopah	78
Booth	20	Nevada Hills	1.30
Columbia Mtn	15	Ophir (Comstock)	1.25
Combination Fraction	1.02	Pittsburg Silver Peak	62
Daisy	41	Rawhide Coalition	31
Fairview Eagle	25	Rawhide Queen	35
Florence	3.42	Round Mountain	84
Goldfield Con	8.30	Sandstorm	16
Gold Kewenas	16	Silver Pick	20
Great Bend	15	St. Ives	13
Jim Butler	17	Tonopah Extension	53
Jumbo Extension	16	Tonopah of Nevada	6.90
MacNamara	29	Tramp Con	7
Mayflower	11	West End	33

Obituary.

Persifor Frazer, who died in Philadelphia, April 7, was a notable scientist of a type rarely found in this country. A man of wealth, he devoted his talent and his time to high endeavor, working in that spirit of intellectual integrity which is more easily possible to one absolved from the need of earning money if he happen to possess a fondness for work for its own sake without using it to display his vanity. He rose far above the level of a dilettante. He was a man of many parts, and gifted with a diplomatic skill that enabled him to play an important part in the organization of geological work both here and abroad. As an assistant on the Second Geological Survey of Pennsylvania and as a member of the International Congress of Geologists his services were especially important.

General Mining News.

ARIZONA.

COCHISE COUNTY.

The Copper Queen Mining Co. is installing a new system for holding 'swelling ground'. On the 300-ft. level of the Holbrook a drift was run in February and timbered with 12 by 12-in. sets. A month later they had to be renewed. These are now to be replaced by posts and caps made with 6-in. I-beams weighing 18 lb. per foot. As the depth of these posts and caps is only one-half of what it previously was with timbering, there will be a material saving in the amount of ground excavated, estimated to be 35 cu. ft. per set. In other parts of the mine timber treated with creosote is being used; also reinforced concrete in the hot parts of the mine where timber soon rots and gets put out of condition.——What is pronounced one of the best ore strikes ever made in the Warren district has been encountered on the 600-ft. level of the Shattuck mine. The sample showed 38% copper and is solid carbonate with a manganese coating. The find was made in the No. 22 raise which was recently started north on No. 8 cross-cut, the raise now being in about five feet of this ore. Development was begun by the Shattuck-Arizona Copper Co. in 1904, and has been prosecuted with great vigor. Byron Pattison is superintendent.

GILA COUNTY.

The special meeting of the Superior & Boston Copper Co., called for the purpose of authorizing an increase of the capital stock of the company from 200,000 to 250,000 shares, has been held in Globe. The increase was authorized unanimously, and will be offered to shareholders of record at $12 per share. At the Great Eastern mine a fine body of copper ore has been developed between the 400 and 450-ft. levels. The new McGaw shaft is being opened rapidly by sinking and raising at the same time, and should be down to the 600-ft. point in the middle of June. W. E. Carter is superintendent.——The Cactus Development Co. is meeting with success in the development of the Arizona National and Pinto Copper properties, situated on Lower Pinto creek, in the western part of the Globe district. The shaft on the Arizona National is down over 400 ft. and the last 200 ft. is in ore, which at the present depth is carbonate and sulphide. The mine is four miles west of the Miami, and has Thomas W. Hamilton as general manager.——George E. Gunn, general manager of the Inspiration Copper Co., is reported to have said that results of exploration will not be known for about two months. The sinking of two shafts and driving of two cross-cuts and one drift are progressing, and the showing of ore thus far is encouraging. One churn-drill has been delivered on the property and will be in operation within a few days, and the installation of another drill will soon follow.

For the past week engineers of the Southern Pacific have been surveying for a line of railroad to connect Cutter on the main line of the Gila Valley, Globe & Northern with the Arizona Commercial railroad at its terminus near the Eureka shaft. The new road will not exceed seven miles in length, and will not require more than a 2% grade. The proposed branch from Cutter will serve the Arizona Commercial, Iron Cap, Superior & Boston, Arizona-Michigan, and Superior & Globe companies, and will soon be a necessity to relieve the congestion of freight.

MARICOPA COUNTY.

The Central Arizona Electric Power Co. has nearly completed its transmission lines to the Octave mine, and will enable operations to be renewed which were abandoned in August 1908. This gold mine is over 1000 ft. deep and has on that level a 5-ft. vein worth over $16 per ton. It is planned to sink the Joker shaft to 1800 ft., and to make connections with the No. 3 shaft of the same property. C. E. Meisse is president, W. W. Wishon general manager, and M. W. Ditto consulting engineer.

YAVAPAI COUNTY.

The Arizona Power Co. is building three electric substations, one of which has already been completed in the Jerome district. It will supply 1500 hp. to the United Verde Copper Co., where George W. Hull is engaged in completing the Cleopatra smelter. Arrangements have been made for delivery of coke and flux, and Hull has over 2000 tons of 14% copper ore on the dump. A new 150-hp. compressor and a hoist have arrived, together with their motors. This company has taken a long time to get down to serious work, and it is hoped that the smelter may soon be blown-in.

YUMA COUNTY.

Preparations are being made by the Daly Mines Co. to operate the Vulcan group adjoining the Mudersbach property, about 12 miles from Bouse. The ore extracted on the surface is oxidized and contains from 2 to 10% carbonate and oxide of copper, with $3 in gold and silver. Carroll J. Daly, of Los Angeles, is president of the company, and has engaged E. A. Haggott as consulting engineer. About a mile from Winchester another gold strike has been made on the Anaconda claims belonging to J. D. Mitchell, of Salt Lake, W. H. Slaughter, and J. T. Hemperly. Winchester is only two miles from the railroad station at Vicksburg and about ten from Salome. Since the discoveries of a month ago the population of these small towns has increased very considerably.

CALIFORNIA.

BUTTE COUNTY.

Harrison Appel, who has been manager of the El Oro and Butte dredges at Oroville since they began operations, has severed his connection with the company to devote his time to mining some claims in Sierra county.

CALAVERAS COUNTY.

The Melones Consolidated Mining Co. is driving a 12 by 11-ft. adit under Carson hill, and has done about three miles, leaving two more to be done. It is equipped with electric cars.——The Reiner Mining Co. has installed a 150-hp. compressor, and is now placing rock-breakers and milling machinery. The Cornish pump has been moved to a more advantageous position, and production is expected to be started this month.

ELDORADO COUNTY.

The Last Chance mine at Coloma is to be re-opened by L. N. Stricker, J. F. Owen, and A. Shafsky, of Placerville. It has been worked by many different parties with varying results, but never on a very systematic plan.——A 12-ft. quartz vein has been discovered by A. Sciaroni at his mine 3½ miles north of Grizzly Flats, which shows free gold in the pan, and also carries a good percentage of galena.

INYO COUNTY.

The Mono Consolidated Copper Co.'s property in the White mountains has been bonded to J. Vernon McConnell, of Los Angeles, for $75,000. The property consists of 12 claims near Hamil station of the Nevada & California railroad, and is considered a valuable low-grade copper prospect. The former owners were John Shortall, H. Levinson, J. S. Johnson, and others.

MONO COUNTY.

The Standard mine is working 80 men, and has recently improved the mill and will enlarge the cyanide plant.——It is understood that negotiations are under way for a transfer of the Yellow Aster mine at Randsburg to a New York corporation for about a million and a half dollars.——Holbrook, the new copper-gold camp in this county, is receiving considerable attention, and a number of strong veins are being developed; but sufficient has not yet been done to estimate the value of the camp.

NEVADA COUNTY.

The Lecompton mine will not be closed down as has been reported, but will be continued under the direction of Samuel Colt, who at present is at Santa Barbara. The mine is open only to the 200-ft. level, beyond which it is still full of water. The heirs of the late A. M. Gilbert own both the Lecompton and the Norambagua, and have decided to continue working the latter mine as well. It has a shaft over 400 ft. deep.——The 10-stamp mill built by a

local iron works has been completed and sent to the Golden Gate mine at Grass Valley.——The last load of machinery for the 10-stamp mill to be erected at the Black Bear mine has arrived at the property, and will be immediately put together. The mill is practically new, having been used but a short time by a company operating near Auburn, in Placer county, and is expected to give satisfactory results.——A. H. Tickell has filed a claim to 5000 in. of water in the Middle Yuba river at a point above the dam used by the Plumbago Mining Co. to divert the water for power purposes. He intends to build a power-plant on the Nevada county side of the river that will generate at least 500 hp. and transmit it to the Graniteville, Alleghany, and Forest City mining districts.——There is a movement on foot to consolidate the Republic and the National mines in the Graniteville district. The president of the Republic company, E. W. Estes, has gone East to consult with the owners of the National mine, which is operated by the Syracuse & California Gold Mining Company.

PLACER COUNTY.

Three wagon loads of machinery have arrived at the Annie Laurie mine, where development is being actively pushed by Captain Hooper. Three new adits have been started and a compressor is being installed. Water-power will be used, as the required 50 hp. can readily be obtained from the ditch of the South Yuba Water Company.

SAN LUIS OBISPO.

A discovery of rich gold-bearing ore in the workings of an abandoned mine in the San Carpajaro region of the Coast range has caused great mining excitement at San Luis Obispo. It is stated that a quantity of the ore has been broken, and is now awaiting shipment.

SIERRA COUNTY.

It is said that the new vein which was found in the Chipps mine above Sierra City, is between 10 and 12 ft. wide, and will mill throughout not less than $10 per ton. ——The Cleveland mine, on the south side of the South Fork between Sierra City and Downieville, has been bonded to John W. Shinn, of New York. Shinn has had experience in the Sierra City district and will prospect the Cleveland on a systematic plan.

SISKIYOU COUNTY.

The Scott Bar Hydraulic Mining Co. is engaged in constructing a 25-mile ditch in the Scott Bar region, capable of carrying 2500 miner's inches of water. It will cost upward of $100,000 to complete. About 13 miles of ditch have now been built.

TEHAMA COUNTY.

At a point 20 miles north of Red Bluff it is reported that a seam of good-grade coal has been discovered while blasting the bank on the side of a road. William H. Bergh has located six claims on the best part of the ground.

TUOLUMNE COUNTY.

The group of claims held by the Horseshoe Bend Gold Mining Co. has been sold to the Empire Gold Mining Co., to the great pleasure of the inhabitants of the region, who contend that the former company never did any honest, intelligent mining. George Morrice will be the manager of future operations, and will immediately start shaft-sinking and install a suitable hoist. Previously there have only been corkscrew tunnels and gopher holes.——An air-compressor and machine-drills will be installed at the Mangante mine.——The mill at the Omega mine is undergoing changes and is being enlarged. Ten more stamps will be installed.

YUBA COUNTY.

The Black Swan gravel mine, on Mooney Flat, near Smartville, is to be re-opened, in connection with other property, by the Sowell brothers, who have already taken the preliminary steps to install the necessary machinery to provide against flooding. This is what caused the Black Swan to close down a couple of years ago, when G. W. Manwell was manager.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—When the compressor for the Joplin Mining, Milling & Tunneling Co. arrives this week the Washington adit will be advanced to cut the Gambetta vein, about 900 ft. distant. During the last week 23 tons of lead ore were shipped to the local sampler, and brought returns of 60% lead, 40 oz. silver, and 0.5 oz. gold per ton. ——It is reported that the Princess of India adit on Columbian mountain, will be advanced next month. It is now in over 1000 ft., and it is intended to drive 900 ft. farther to cut under the American Sisters vein at a depth of from 700 to 900 ft. under the present workings. A compressor is to be installed, driven by electricity furnished by the power-plant two miles below Georgetown. As soon as the American Sisters vein has been reached, it is the intention of the manager, J. J. White, to move the 25-ton concentrating mill from the upper workings to a site below the dump of the Princess adit.——Work has been resumed upon the Butler mine. The adit is being driven ahead, while the shaft is to be sunk another 100 ft. E. M. Moscript, of Idaho Springs, who is constructing a concentrating plant for the low and medium-grade ore exposed, expects to have the mill ready during the next 60 days. It will also treat custom ores, a contract having been entered into with S. D. Coffin, manager of the Coffin mine for the milling of his ore.—— Work has been resumed upon the Mazeppa group of claims, situated on Democrat mountain. The adit, in 700 ft., is to be driven ahead, while drifting is to be put under way upon the Mazeppa vein which was intersected about a year ago. M. Jacoby is manager.

Georgetown, April 23.

The Smuggler mine in the Brown Mtn. district passed to the control of the Hollingsworth Mining Co. a few weeks ago, for $22,000 in cash. The shaft is now 300 ft. deep, and the management intends sinking another 150 ft., with drifts 75 ft. apart. Lessees who have been extracting ore will be permitted to continue their work. Several of them have taken out very high-grade ore, alongside of which is 3 ft. of mill grade which is concentrated at the Terrible mill. The Smuggler and other veins in the group run parallel with the Terrible and Dunderberg. The Terrible has been worked to a depth of 1465 ft., the ore-shoots having been found to be continuous. Both veins will be worked together.

LAKE COUNTY.

T. J. Dalzell, the Commissioner of Mines for Colorado, has published the mineral statistics of the State in the past year showing that the total gold production was $22,695,575, of which Lake county is credited with 67,383 fine ounces, worth $1,392,800. The county also produced 3,216,000 oz. silver, 14,380,000 lb. lead, 5,330,000 lb. copper, and 23,400,000 lb. zinc, with a total value of $5,461,000.——The Langola Mining Co., which has been operating the Pyrenees and R. A. M. properties for the past year or more, has temporarily suspended operations on account of the difficulty in handling the water. However, arrangements are being made to install a pumping plant of greater capacity. Pumping had been maintained to a depth of 1150 ft., when it became too heavy to cope with. It was then ascertained that the company was handling the water from the Wolftone and Greenback properties as well as its own; and up to the present the Langola company has not been able to arrange for co-operative pumping with these other two mines.

OURAY COUNTY.

Over 1000 ft. of headway have been made in the Kohler tunnel of the San Antonio mine near Red mountain, and another called the Robber tunnel has been advanced about 800 ft. At present all ore is being taken out through the Carbon Lake shaft, and the expense of hoisting and hauling will be materially reduced when these tunnels are completed. John Roper, the manager, reports that 4110 tons of ore were shipped to the Durango smelter in the 6 months preceding February, averaging 11% copper and netting $16.89 per ton.

TELLER COUNTY.

It is estimated that $550,000 will be required to complete the 15,500 ft. of the Cripple Creek Drainage tunnel, and of this amount only $388,500 has been subscribed by the mining companies of the district. The plan is to assess the various companies proportionately on the basis of benefits to be derived. The Colorado Springs Mining Stock Association has been asked to contribute $5000 to the fund. A committee, consisting of Frank G. Peck, president of the Portland, A. L. Burris, president of the El Paso, and F. F. Castello, president of the Mary McKinney, is making a campaign to raise $160,000 needed to complete the work, which will give a new lease of life to the entire Cripple Creek district.

IDAHO.

ADA COUNTY.

The Black Hornet district, 12 miles east of Boise, is more active than it has been for a number of years. At the Hornet mine roads and buildings are being constructed, and a shipment of structural steel with parts of a 30-stamp mill has recently arrived. Power will be secured from an electric plant at the Barber dam. The Viola mine has been acquired from the War Eagle Mining Co., and is said to be in well developed condition.——Half a mile north of these claims lies the Adelmann group, controlled by A. Adelmann of Boise. He believes his ore to average $12 in gold, and hopes to build some plant for treating it. The ore, however, is not suited to the cyanide process.

BOISE COUNTY.

Robert Abernathy, of Spokane, president of the Golden Age Mining Co., operating in Boise basin, where an important strike was reported a few days ago, announces that 15 stamps will be dropping in May. When work was resumed last winter and the adit had been advanced 486 ft. an orebody 3½ ft. wide was encountered assaying from $20 to $40 per ton. The latest strike is on the 300-ft. level. The property is financed by the owners and no stock has ever been offered for sale.

ELMORE COUNTY.

The Minerva mine is working the Minerva lode at Atlanta, parallel and 2000 ft. west of the Last Chance lode. Thirty men are employed. The mine is developed by a cross-cut adit 850 ft. long intersecting two veins 50 ft. apart. But little work has been done on the first vein, though it shows some good ore. The second vein has been developed about 400 ft. on each side of the cross-cut. The ore is conveyed by a gravity tramway 1800 ft. long to the 10-stamp mill on the Yuba river, which has been in operation for several months. As the ore is mined near the surface, a good extraction is made by amalgamation. Two years ago the company installed a patent cyanide process for treating the tailing, but it proved a failure, and the tailing is being stored for future treatment. The company intends to drive a cross-cut adit from the level of the mill to cut the vein 1200 ft. below the present workings.——The Atlanta Gold & Silver Mining Co. has resumed work on the Atlanta lode after a shut-down of 7 or 8 years. The mine has been developed by a number of adits, most of which have caved, but one of the principal is being re-opened. A 20-stamp mill on the Yuba river belongs to the company and will be remodeled this summer.——A number of small prospects are also being worked, and the outlook of this camp, one of the most beautiful in the State, is brighter than it has been been for years.

IDAHO COUNTY.

Reports of a new strike from the Ten Mile district have caused quite a stir in Central Idaho. It appears that Dan Bennett has found a 26-ft. vein near Newsome that pans free gold at any point in its width. The discovery was not announced till Bennett and his friends had taken up all the best ground, and the inaccessibility of the district has also tended to keep out the stampeders who invaded the Four Mile district about a year ago.——The Knob Hill mine has been sold to Frank Peck, manager at the South Fork mine. It is reported that a number of other claims on Knob Hill are about to change hands. The Knob Hill mine is southeast of Orogrande and belonged to Orrin Lamb.——The shaft on the Iron Crown mine, near Newsome, is now down about 62 ft., showing 2½ to 3 ft. of ore that assays $50 per ton. W. M. Garner has been in charge of the work for W. V. Garrett & Co. of Spokane, who purchased the property last fall.

LATAH COUNTY.

The Mountain Gulch Mining & Milling Co., headed by W. E. Seelye of Spokane, has resumed lode mining on its property in the Hoodoo district, where previously there has only been placer mining. The property has the first discovered gold vein in the district and was for years operated by the Taylor brothers, of Farmington. A re-organization was effected by J. J. Browne, W. E. Seelye, and others a year ago, and they have installed a 2-stamp mill and concentrator with a daily capacity of 150 tons. More machinery will be added during the year.

SHOSHONE COUNTY.

It is rumored that the Monarch mine, near Murray, will be taken over by the Paragon Consolidated Mining & Milling Co., which already owns several mines, including the Chicago-London, Paragon, and the Jewell. The Monarch has been developed by five shafts and a long adit, and is under the management of Herbet Auerbach, who is now abroad.——The ground for the new concentrator for the Alice Mining Co. has been cleared and it is expected that the work of erecting the buildings will be begun immediately. The concentrator will have a capacity of 100 tons a day, and funds for its erection have already been subscribed. James F. McCarthy, of Wallace, has charge of the placing of the orders.

A decision of paramount importance to the Coeur d'Alene has just been handed down by the Supreme Court of the State of Idaho in connection with the appealed case of Thomas Wall against the Basin Mining Co. The effect of the decision is that stocks which are marked "non-assessable" cannot be assessed. Wall sued the Basin company for a large number of shares which had been sold at a delinquent sale for non-payment of assessment. The case was tried in the District Court and a decision issued in favor of the defendant company. This decision has been reversed by the supreme court.——Work on the Amy group of claims, which was recently bonded by Spokane men from Gus Smith for $40,000, has been stopped. The property had only been taken over about a week, and development had just commenced when a representative of those interested came to the district and paid off the men. It is believed that the bond has fallen through, and it is now reported that the property is to be taken over by Portland men. A strike of gray copper ore has been made in the long adit being driven on the property of the Copper King company at Mullan. The strike was made at about 1200 ft. from the portal, but owing to the heavy flow of water the extent of the orebody has not been ascertained. The Copper King claims are being developed through the ground of the Copper Center Co., and it is not yet known whether the present ore lies at the end of the Copper Center ground or at the beginning of the Copper King land.——A small force of men has been set to work cleaning out the workings of the Stewart mine prior to the expected visit of F. Augustus Heinze to the district, when it is expected that a large force of men may be set to work. The company has just acquired three claims adjoining on the east, for a consideration in the neighborhood of $10,000.——An assessment of 2½ mills per share has been levied by the Bullion Mining Co., and accompanying the notice a statement of the affairs of the company has been mailed to the stockholders. This statement says that it is the intention of the company to sink the shaft another 100 ft. and to install pumping equipment. The financial report shows a large amount to have been expended on development and is considered satisfactory.——A contract for 600 ft. of raising from the 1400 to the 600-ft. levels on the Monarch mine is about to be let.

MONTANA.

LEWIS AND CLARK COUNTY.

In the United States Circuit Court on April 17, Judge Hunt appointed Cornelius Hedgen and E. P. Walters, both of Helena, receivers for the Bald Butte Mining Co., representing the minority and majority interests respectively. The Bald Butte Co. is one of the most famous of Montana gold producers, and has paid upward of $1,000,000 in dividends. The action was taken at the request of the Boston creditors.

SANDERS COUNTY.

Martin Cook and M. Woodwell, of Spokane, have taken a contract to run 100 ft. of adit on the Montana Gold Mining & Milling Co.'s property three miles from Heron. The adit will run under the shaft to cut the vein at depth. There is an orebody now exposed in the shaft which runs about $120 per ton in free gold. Some mining engineers have recently offered to take a lease on the ground and to pay 20% royalty on the ore. Charles Sawdey is manager.

SILVER BOW COUNTY.

The East Butte Copper Mining Co. proposes to increase the capital stock by 300,000 shares to acquire 83% of the holdings of the Pittsmont Copper Co. This latter company owns 90% of the stock and all the bonds of the Pittsburg & Montana Copper Co., which operates the Pittsmont mine and smelter at Butte. The mine has been opened to 1500 ft. with the most important development done on the 800 and 1200-ft. levels, where important orebodies have been found. Horace V. Winchell in his report on the mine says that it is not practicable to make an estimate of the ore reserves, but has no doubt that the mine can produce 350 tons per day for several years to come. The production at present is 150 tons of first-class, and 200 tons of second-class ore daily. At the smelter one blast-furnace is operating, and a second is under construction, together with a matting furnace for flue-dust. Equipment at mine and smelter is substantial and represents an investment of over a million dollars. The consolidation will make the East Butte one of the largest mining properties in the camp. Oscar Rohn will continue as general manager.

NEVADA.

ESMERALDA COUNTY.

The preliminary survey of the Ely & Goldfield railroad has been completed, and the chief engineer, C. M. Rasor, is in Ely awaiting the arrival of John Ryan, the manager of the Tonopah & Tidewater.——The report of the Round Mountain Mining Co. for the year ending March 31 shows that 6775 ft. of work were done. The main incline shaft is now 738 ft. deep, and levels have been opened on the 500, 550, 600, and 700-ft. There are 39,900 tons of ore blocked out, estimated to be worth $12.30 per ton, and 29,500 tons were taken out during the year at a cost of $6.07 per ton. The manager, James R. Davis, believes that the installation of machine-drills and electrically operated machinery will reduce the mining and milling costs by 15%.——A large force of extra men will be put to work by the Goldfield Consolidated Mines Co. within the next two weeks for the purpose of drifting north and south on the lower levels. The main shaft on the Clermont is down 1050 ft., and a station is now being cut at the 1000-ft. level. The downward extensions of the ore-shoots of the Mohawk and Red Top are said to be fully as evident at the 750, 875, and 1000-ft. levels as above, if not even more extensive and rich. No driving or cross-cutting has been done on the Consolidated below the 600-ft. level of the Mohawk claim, which, at that level connects with the Clermont shaft.

NYE COUNTY.

(Special Correspondence).—The Bonnie Clare M. & M. Co. has been re-organized with a capital of $1,250,000. One share of new stock will be exchanged for four shares of the old, the distribution to be made by the court following the dissolution of the old corporation. Money realized from sales of stock will be devoted to the development of the Corbett and Rattlesnake claims, where fair-grade ore has been opened up. The mill will be moved from its present position to a spot between the two claims. It is said that the mill will be turned over to a company which will treat custom ore, with special arrangements made for treatment of the Bonnie Clare output. S. F. Owens is president and Don Carlton secretary.——A vein of high-grade ore has been struck at a depth of 210 ft. in the Crown Point Globe, in the 50 ft. of ground leased from the Johnnie Con. The company is straightening its incline shaft, and has opened 20 ft. of the ore. The mine is producing about $3000 per month.——The Johnnie Con. will sink its shaft to the level of the lower Crown Point Globe workings in hopes of striking the rich vein opened in the latter. At the 700-ft. level a 12-ft. body of ore running $10 per ton is being worked. A No. 2 Gates 100-ton crusher, retort furnace, amalgamating house, clean-up barrel, and other apparatus have been recently installed. Last month the Johnnie Con. produced approximately $12,000.

Rhyolite, April 23.

The seventh annual report of the Tonopah Mining Co. of Nevada, covering the period from February 29, 1908, to March 1, 1909, has just been received by the stockholders, and shows that 162,750 tons were milled, averaging $23.61 per ton. The cost of mining and milling was $8.96, and the total disbursements were over $2,700,000, of which $750,000 were paid out in dividends. The net surplus of the year is $1,001,098, and there are estimated to be 367,000 tons of ore reserves worth $21.11 per ton. During the last week an average of 93% of the stamps were dropping all the time, and crushed 3035 tons of ore. Twenty-six tons of concentrate was shipped.——J. V. Priest, manager for the Mogul Consolidated Mines Co., reports that at the main working shaft there are 3000 ft. of workings, for the most part in ore, and much of it high grade. The new vein on the 300-ft. level is 9 ft. wide and worth $14 per ton. Development is being advanced on the 410 and 550-ft. levels to cut this same vein. Promoters are now in London negotiating for money to build a mill on the company's property.——Acting under telegraphic advice from the president of the Homestake King, S. B. Tyler recently closed down the Homestake mine and mill in Bullfrog. Tyler says that the ore reserves have been so nearly worked out that until more ore is placed in sight in the mine it is unreasonable to continue. He has recommended deeper development, hoping to open additional reserves below the 500-ft. level.——The Pioneer lease has made another sensational strike on the 210-ft. level, and all the machine drills in the upper levels have been moved to the place. An order has been placed for a new 12-drill compressor. An electric hoist is also planned for, to be installed on the 210-ft. level. This is to be used in sinking on the ore.——A complete dredging outfit has been shipped from Sacramento to Manhattan, to be placed on the Wilson ground in the main gulch. This is the result of the recent visit of M. A. Nurse, president of the dredge company, and A. M. McCollum, one of the directors, who spent several days in the placer camp.

WHITE PINE COUNTY.

Spring valley, 6 to 8 miles wide and 60 miles long, is between the Schell Creek range on the west and the Snake range on the east. On the Schell creek slope, facing this valley, are the Siegel, Muncy, Lucky Seven, Piermont, and Goshute mining properties, all partly developed and having ore; on the Snake range side are the Red Hill, White Cloud, and Allen, similarly developed. The Muncy, Siegel, Piermont, and others in Schell Creek range, have gold, copper, and silver ores; those in the Snake being lead and silver. The Muncy belongs to the Schell Creek Range Ore Develoment Co., the work on which is being directed by E. L. Fletcher and O. McCarney. Their camp on the east slope of the range is 24 miles east of Smelter, and they have finished a wagon and automobile road, having a maximum grade of 8%, between those points. The work done on the Muncy amounts to about 800 ft. The property was examined and recently reported on by Edwin E. Chase, of Denver. The plan is to ship ore to the smelter at Smelter.——The Copper Mines Co. has a group of 55 acres on the Ely copper belt,

lying between the Ruth and Copper Flat groups of the Nevada Consolidated. This is a Gunn-Thompson property, and is superintended by H. R. Plate, of Ely. Within the last year a 2-compartment prospecting shaft has been sunk 240 ft. and levels have been driven from the 215-ft. station; in addition to this 8 churn-drill holes have been sunk, each to a depth of over 600 ft. Much lateral development will be done this year from the shaft to connect with all the drill-holes. This company owns the old Chinaman mine, and it is intended to prospect that ground with churn-drills this year. An additional drill will probably be purchased.

OREGON.

DOUGLAS COUNTY.

A valuable mineral find in southern Oregon has been reported by G. W. Morris, an old-time prospector from California. It is a vein of copper ore carrying $17 gold per ton, and out-cropping for a distance of 600 ft. It was found about eight miles south of Roseburg.

UTAH.

SALT LAKE COUNTY.

James P. Graves reports that the Bingham Mines Co. has over $200,000 cash in hand at the end of its financial year. During the year the company has acquired title to the mines and property of the Bingham Consolidated Mining & Smelting Co., but owing to the delay in obtaining possession of this property it has been impossible to operate the mines till recently.

TOOELE COUNTY.

The Boston Sunshine plant is being started near Mercur by John and George H. Dern, to treat about 150 tons of ore per day. Various modifications have to be made in the arrangement of some of the new devices, but in general things are running as smoothly as can be expected. At the Ingot mine in the same region Dern is drifting along a fine-looking vein at a depth of about 1000 ft., but so far it has not proved to be of commercial value.

WASHINGTON.

FERRY COUNTY.

The Southern Republic Mining Co. has been organized by O. B. Hollis and A. R. Sweet, of Spokane, G. M. Fripp, of Grand Forks, and J. T. Hollis, of Waverly, to operate a group of claims adjoining the New Republic property on the south. The surface ore runs from $6 to $50 per ton and is a continuation of the vein of the New Republic. Professor Aughey, of Spokane, who made an examination of the property, believes that it will turn out as good as the New Republic mine.

STEVENS COUNTY.

Announcement is made that construction work on the Spokane, Wallace & Interstate railway will begin in a short time. The line will be 84 miles long, the distance from Wallace to Coeur d'Alene being 52, and from Coeur d'Alene to Spokane 32 miles. The present time required for the trip to Spokane by way of Harrison and Coeur d'Alene is five hours.——C. C. Anderson's ranch in Black canyon, six miles east of Northport, was the scene of a rich gold strike on April 21, picked samples assaying $740 per ton. Considerable excitement ensued and a number of prospectors have gone into the canyon to stake out claims. Anderson found traces of gold in an old creek bottom near his cabin some time ago, and followed the course to the hill above, where he has since done active work, and from which he took the samples.

CANADA.

BRITISH COLUMBIA.

Le Roi No. 2 shipped 2620 tons of ore to the smelter in March, and received $62,300 in payment of previous shipments. This company is employing 125 men at the mine and concentrator, while there are 410 employees at the Centre Star group; other small properties make up the total number to 565 men. When the other Le Roi resumes it is hoped there may be 800 men at work, as there were in 1908.——Mining prospects in the Lillooet district are looking bright. On Cayoose creek, a placer proposition controlled by the Vancouver Enterprise Co., is being worked with 18 men, operations having been started recently. In addition to this, work has opened up at a hydraulic mine on Alexander creek, a tributary of Bridge river, and work has also been started at the Ben d'Or mine. This last mentioned is a gold quartz mine, and the stamp-mill will be started as soon as weather conditions permit. The gold dredge which has been operating on the Fraser river at Lillooet is now at work.

ONTARIO.

The King Edward mine at Cobalt began active work in the early part of 1907, when a 13-drill compressor and two 100-hp. boilers were installed. There are now in the mine 7500 ft. of drifts and 1230 ft. of shafts and raises, developing four productive veins. The most recent vein discovered is characteristic of the King Edward, being about 3 in. across and carrying between one and six thousand ounces of silver per ton. A 10-stamp concentrator treats the ore. The high-grade which averages 2500 oz. per ton is picked out, and all the rest of the ore goes to the mill, which treats about 20 tons per day. The milling ore runs in bulk 45 oz. per ton. About 15 tons of concentrate are produced monthly. It is quite likely a larger concentrator will be installed later. Glenn Anderson has charge of the mine with a force of 70 men.——An order-in-council was issued on April 21, throwing open 1,439,300 acres of land in the Algoma district for prospecting. The land lies north of Sault Ste. Marie, and the Government has good reason to believe that there are valuable minerals on the property.

Official figures show that the ore shipped from Cobalt in 1908 contained 19,394,496 oz., valued at $9,112,746, and the by-products of cobalt and arsenic brought the total value for 1908 up to $9,229,768.

YUKON TERRITORY.

The records for the fiscal year ending March 30 show that during the previous 12 months 288 quartz claims were staked, no less than 40 of which were located and recorded in March. The heaviest staking was done last July, when 58 were offered for record. The first quartz claim staked in the territory was recorded in August 1894, since when over 1000 have followed suit. The largest aggregate belongs to the Dawson City Quartz Mining Co., which possesses 19 claims.——A hundred sacks of ore from the Jupiter-Mars property on Chatham creek has been put through the business men's stamp-mill, and netted an average of $20 per ton on the plates.

MEXICO.

CHIHUAHUA.

J. Gordon Hardy, manager for La Republica Mining Co. in the district of Rayon, has almost completed installing the additional plant at the company's mill. There will now be 15 stamps, two tube-mills, Wilfley concentrators, and the cyanide plant. The present output is about ₱80,000 per month.

DURANGO.

It is reported that the machinery and equipment of the Compania Nacional Mexicana de Fierro y Acero are to be sold. This company has been working the famous Iron Mountain, or Cerro Mercado, with a force of 200 men under the direction of T. F. Witherbee. The latter has estimated a tonnage of 350,000,000 of specular hematite to be available for smelting with an average of 63% Fe and an inconsiderable amount of phosphorus. The main thing that has prevented the Iron Mountain from becoming a prodigious producer has been the untoward expense of fuel.

JALISCO.

It is reported that the Magistral-Ameca Copper Co. will erect a smelter instead of a concentrator, to have a daily capacity of 150 tons per day. H. L. Percy and James P. Harvey, vice-president and manager of the company, have ordered the required plant in Denver.——The Amparo Mining Co., operating near Etzatlan, will pay its second quarterly dividend on May 10, at the rate of 2½%. A Burt filter is being installed in the cyanide plant. James H. Howard is general manager for the company.

Special Correspondence.

MEXICO.

Protection for Mexican Coal.—Costs of Living.—Jalisco Power Concessions.—Amparo Mill.—Presidential Message.—Railway Improvements.—Colima.

The railroads and coal producers of Mexico have won their fight for either a duty or a discriminating freight rate on foreign coals and cokes, and the President has authorized the issuing of instructions to the railroads to increase the freight rate ₱1 per ton on all coal and coke entering Mexico by Vera Cruz, Tampico, or Laredo. The rate on coal and coke entering by El Paso is not raised, as it is understood there is already some kind of a differential rate applying there, and also the longer haul for material entering through that gateway gives the home product greater advantage than it enjoys at other points, even with the increased rate. At Chihuahua, however, foreign coal and coke can be laid down cheaper than the native fuel. This is a clever move by the Mexican Government, for, having control now of practically all the trunk lines of the Republic, this method of increasing railroad receipts strengthens materially the securities of the National Railways of Mexico. In another sense, however, it is a somewhat suicidal policy. Mention has been made before in these letters of the heavy burdens that had to be borne by the mining industry throughout the Republic, by reason of the excessive tax on every article of consumption and of production, as well as high transportation charges, and it was shown that any increase in the cost of fuels would eventually have to be paid by the miner. The low prices of the metals may be borne with patience, for there is the hope and belief that it is only temporary; but the cost of everything now frightens him. Time was when a person could live in Mexico for the same number of pesos that it cost him in dollars in the United States; but it is not so now. The production of the country is not equal to the demand, and prices have risen; foreign articles, that were once obtained at a reasonable figure, went up in price with every rise in exchange, and never were lowered; the Mexican duties have steadily risen, and within the last six months they have again been raised, in some instances as high as 60% above the former tariff rate. As a consequence the costs of living and all other expenses and supplies, whether for the home, mine, or factory, are now as high in Mexico in actual gold money as in the United States, and in many cases higher. This takes away many of the former attractive features, there remaining then only the lack of great competition and opportunities for enterprises of large capital, which the Mexican has not at his command. It is no longer the country for the poor man.

The more accessible mining interests of Jalisco, that is, the properties about Ameca, Etzatlán, and Hostotipaquillo, are considerably elated over the merging of the Cuesta and Pimental concessions and companies on the electric power and transmission lines through the said districts, for, while it may mean a reduction of competition, and possibly a higher cost for power, it means undoubtedly a larger capital in one enterprise without the necessity of duplication, and a consequent more prompt realization of the desires of these mining districts. The recent splendid finds at El Favor, Cinco Minas, San José de Ventanas, and the Buena Vista, in the Hostotipaquillo district, make them, as well as others nearby, most anxious or the electric power, that they may more economically increase their operations and productions. The contemplated improvements at the Magistral copper mines, near Ameca, in the shape of a 150-ton reverberatory smelting furnace, will be installed in time to take advantage of the electric power line. The Amparo Mining Co. of Etzatlán, whose recent report showed such excellent results from the Santo Domingo mine and mill, will also be about ready for an addition to its mill by the time the wires reach it. The Burt filter, designed by Edwin Burt of El Oro M. & R. Co., is being placed in the Amparo mill to handle the slime, and if it proves a success others will be added. Felipe Hueso is supposed to have sold his mining interests in Ayutla to Americans for ₱30,000, and it is to be hoped these properties may now be opened up, as their showing deserves. Mr. Hueso has been working them to the extent of his capital for a number of years, doing a little reverberatory smelting; and for generations back they have been a means of livelihood to many in that part, as the many copper utensils in use by the natives bear witness.

The President's message to the Mexican Congress that convened on April 1 was a general review of the country's affairs. Attention was called to the saving at Cananea by the use of fuel oil brought in free of duty under a Federal concession, and the statement was made that a like concession had been made to the Banco del Oro Mining Co., of Magdalena, Sonora, and would be granted to others that might apply. It was expected that at this session of Congress an endeavor would be made to obtain from Congress some measure for the increased use of silver. As yet, however, no move has been made. The banks are endeavoring to encourage the people, but the price of metals continues low and depresses the mining industries. Little rain has fallen, there has been no spring sowing, and there is consequently little work in the agricultural districts. Numbers of people are in actual want. Unless rain comes serious uprisings or bread riots are predicted. Assistance may be given through railroad construction in connection with the Chihuahua & Pacific, the Southern Pacific, and the National



Colima.

Railways of Mexico, all of which have planned important improvements. These on the old Mexican Central line alone amount to ₱12,000,000, which can be paid from the estimated saving by reason of the railway merger. The broad-gauging of the Interoceanic is also planned.

The volcano of Colima is again showing great activity, reports stating that lava is being emitted in large quantities, that being an unusual phase for this mountain. The eruption is accompanied by extensive earthquakes, which have involved an area as far south as Oaxaca. Immense quantities of volcanic ash are said to have fallen in the city of Colima, which lies some leagues distant from the base of the volcano.

WASHINGTON.

Taft on Conservation. — Tariff on Zinc and Iron Ores. — National Academy.—Assessment Work.—Forestry.

President Taft has declared in favor of the forest and conservation policies advocated by Mr. Roosevelt. The announcement which was made by Gifford Pinchot in behalf of Mr. Taft is as follows: "Any statement that President Taft is not in sympathy with forestry and the conservation movement is without foundation. On the contrary, I am authorized by the President to say that he is in entire sympathy with the forest policy and the conservation policy as already developed, and stands behind them. I am also authorized by the President to deny categorically the story that great areas are to be thrown out of the national forests by presidential proclamation."

It is a safe presumption that when the tariff bill finally

passes both houses a great many interests will be displeased. After the House and Senate had agreed to a duty of 1c. per pound on zinc in imported ore, which was to keep out Mexican ore, it was thought the matter would end. Representatives of the smelters have, however, told Senator Smoot that this duty would result in Mexican ore being sent to England, to the injury of American smelters. Senator Smoot, who is handling this schedule for the Senate, announced that the smelters and producers would have to get together and come to some agreement. A compromise duty of ½c. per pound, with ores containing 25% or less of zinc admitted free, has been suggested. The Senate in reporting the tariff bill placed a duty of 25c. per ton on iron ore. Ore is now paying a duty of 40c., and the United States Steel Corporation is supposed to be insisting upon at least 30c. The story is being told in Washington that Andrew Carnegie has lined up with Charles M. Schwab of the Bethlehem Steel Co. for free iron ore. Carnegie, it is said, always believed in Schwab, and did not like it when the steel trust threw the young man overboard. The United States Steel Corporation gets its main supply of ore from Michigan and Minnesota. Mr. Schwab gets a portion of his ore supply from Cuba. It would mean much to him to get his ore free. Members of the House all took a fling at the Sandard Oil Co. when they placed petroleum on the free list. It was a popular blow at the octopus, and they were all happy. Independent oil producers and refiners now, however, protest, asserting that the Standard Oil Co. produces only 11% of the crude petroleum in the United States, while the independents produce 89%. The Standard Oil refines 82½%. The independents ask for an ad valorem rate of 50% on crude petroleum and all products thereof, and also ask that these products be excepted from the drawback clause of the Payne bill.

At the meeting of the National Academy of Sciences which closed here Friday the following new members were elected: Joseph S. Ames, Johns Hopkins University; Oskar Bolza, University of Chicago; Henry Crew, Northwestern University; Waldemar Lindgren, U. S. Geological Survey; Thomas H. Morgan, Columbia University; Maxime Bocher, Harvard University; F. W. Clarke, U. S. Geological Survey; John M. Clarke, State Geologist of New York; and Henry L. Wheeler, Sheffield Scientific School. Foreign associate members were elected as follows: Prof. Albrecht Penck, University of Berlin; Prof. Gustav Retzius, University of Stockholm; Prof. Wilhelm Waldeyer, University of Berlin; and Prof. Wilhelm Wundt, University of Leipzig. The next meeting will be held in November at Princeton, New Jersey.

William H. Andrews of Albuquerque, delegate from New Mexico, has introduced a bill to suspend the requirement of not less than $100 worth of labor on each mining claim during each year, so that these claims shall not be subject to forfeiture for non-performance of the annual assessment work. The claimants of any mining location, in order to secure the benefit, are required to cause to be recorded a notice that they in good faith, intend to hold and work their claims. Kanute Nelson, Senator from Minnesota, in a bill which was referred to the Committee on Public Lands, seeks to amend the statutes so that in the district of Alaska any person asserting an adverse interest to a tract of land sought to be patented shall, during the period of posting and publication, or within 8 months thereafter, file such claim, and within 60 days begin an action to quiet title in a court of competent jurisdiction. After judgment has been rendered the party entitled to possession shall pay to the receiver $5 per acre for his claim, together with the proper fee.

Simon Guggenheim, Senator from Colorado, proposes that for instruction in forestry in the agricultural colleges and experiment stations the sum of $2500 be appropriated each year for each school or experiment station. Mr. Guggenheim specifies that the instruction in forestry shall deal with the management and care of wood lots and forests, and the planting of forest trees, and may be conducted in any manner best adapted to reaching the largest number of persons, but shall not be used for the purpose of educating technical or professional foresters. A concurrent resolution by Willis C. Hawley, Representative from Salem, Oregon, declares that it is against public policy and unlawful to annul or otherwise dispose of any portion of the public domain, by constructive establishment of Indian reserve or for any other purpose, or any specifically granted lands, to the several States subsequent to the granting act, without first making an equitable adjustment by adequate indemnity. J. K. Kalanianaole, Delegate from Honolulu, Hawaii, has introduced a bill extending provisions of the Reclamation Act to Hawaii. Another attempt is to be made to provide a building for the United States Geological Survey. Today S. Guggenheim, Senator from Colorado, introduced a bill providing for a new building and site, to cost not more than $1,100,000. No plan is to be selected that cannot be executed for $950,000. The bill seeks to create a building commission, with the Secretary of the Interior, the Superintendent of the Capitol, and the Superintendent of the Library of Congress as members.

DENVER, COLORADO.

San Juan District.—Activity near Crestone.—Clear Creek County.—Wyoming Oilfields.—New Railroad Planned.—Cripple Creek.

The San Juan district is beginning to be visible after one of the hardest winters in its history. In some places where the power lines have been carried on poles 30 ft. high it was found necessary to splice these to keep the lines out of the snow. The recent warm weather has caused a few slides near Ouray, but no serious damage has been done as yet. That portion of the San Luis valley known as the Baca Estate has been purchased by the Baca Land Grant Development Co. and divided into tracts suitable for agriculture and for mining. Prospecting permits and leases are freely granted. Lessees have already opened the old Independent mine near Creston, idle for the past five years. The mining and timber land on the grant will be sold by lottery after it has been thoroughly prospected. About a year ago there was considerable excitement at Silver Plume over connecting the Burleigh tunnel with the Seven-Thirty shaft through the Phillips raise. The event was anticipated with interest, as the water in the shaft was 700 ft. deep. The old surveys were evidently incorrect, since the shaft was not encountered at the point expected. The contractor having made the raise according to his agreement left the work. The management of the Seven-Thirty mine has since been considering the best means of completing the work. It has been decided to pump the water and then make the connection. The pumps are now being assembled. The old Symonds Forks mine at Central City has been awarded to F. Sternberg by the decision of the Supreme Court reversing the decision of the District Court. This mine is one of the oldest and best locations on Quartz hill.

The Northwestern Oil Refining Co. has begun the erection of a refinery at Crowley, Wyoming. The greater part of the machinery and the pipe for the line to connect the refinery with the Byron field is on the ground. The Lander Oil Co., of Lander, Wyoming, has a lease on 4000 acres in the Wind River Indian reservation. A prospect hole has been started by this company. The Treasure Mountain R. R. Co. was incorporated in Denver, on April 12. The road will extend from Redstone, in Pitkin county, to Anthracite, in Gunnison county. It will connect the quarries of the Crystal River Marble Co. with the Crystal River railroad, and will also give an outlet for the Tewk Mining Co. The new quarries will compete with the quarries at Marble, which have already made Colorado famous as the producer of large blocks of excellent marble.

Another case of high grading has been unearthed by the management of the Golden Cycle mill at Colorado City. This is the second case discovered at this mill within the last 3 months. About $5000 has been recovered. The shipments from Cripple Creek have been heavier thus far than for any month of the year. The Doctor Jack Pot Mining Co. has filed suit against the Work Mining & Milling Co. to recover the value of ore amounting to $2,245,000. It is

claimed that the Little Clara vein on which the defendant company has been working for the last two years has its apex on the Doctor Jack Pot property. The Vindicator Consolidated Gold Mining Co. has issued a circular, announcing that the regular quarterly dividend due on April 25 will not be paid, owing to the poorer grade of ore encountered, and to the payment of taxes. This company has paid 43 dividends amounting in all to $1,980,000. M. B. Burke and associates have secured a long-time lease on 17 acres of ground on Beacon hill belonging to the Black Belle Gold Mining Co. The Union Leasing Co. has contracted to furnish the compressed air. A trial shipment has already been made from a stope at the third level of the Black Belle shaft.

KALGOORLIE, WESTERN AUSTRALIA.

Chaffers Mine.—February Output.—Vacuum Plants.

There is little to report for February, with the exception of good diamond-drill results in the Associated, and a more favorable outlook for the South Kalgurli. In the Chaffers mine, at the south end of the belt, underground development was disappointing, but in the cross-cut at the 200-ft. level a lode 5 ft. wide, assaying $14 per ton, was passed through.

The State's gold output for the month was valued at $2,553,000, and dividends amounted to $13,500. The monthly returns from the chief producers were as follows:

Name.	Tonnage.	Value.	Profit.
Associated	10,881	$108,000	$ 33,000
Associated Northern Blocks.	3,410	32,500	13,500
Golden Horseshoe	21,933	251,000	100,000
Golden Link	3,222	31,000	3,500
Golden Ridge	2,170	27,500	14,000
Great Boulder Perseverance.	16,990	128,000	35,000
Great Boulder Proprietary..	14,759	220,000	116,000
Great Fingall	13,140	68,000	500
Hainault	4,728	30,500	1,000
Ivanhoe	18,023	205,000	105,000
Kalgurli	10,020	135,000	75,000
Lake View Consols	7,306	53,000	12,000
Oroya-Brownhill	10,585	99,000	40,000
Oroya-Black Range	4,410	55,000	20,000
Sons of Gwalia	12,170	102,000	35,000
Sons of Gwalia South	1,800	23,000	6,500
South Kalgurli	9,033	61,000	14,000

The Cassel plants at work here on old residue treated 27,639 tons, for a return of $29,500. A vacuum plant is being erected on the Great Fingall in the Murchison. The treatment of slime by vacuum process is gaining ground in this State, yet in Kalgoorlie alone filter-presses are responsible for a monthly return of 100,000 tons. During 1908 Western Australia produced 7757 tons of copper ore, giving a return of 1112 tons copper.

BISBEE, ARIZONA.

Calumet & Arizona. — Superior & Pittsburg.—Copper Queen.—Great Western, Courtland.

A new orebody has been opened recently in the Calumet & Arizona on the 1150-ft. level near the end-line of the Sunny Side claim of the Superior & Pittsburg Co. In the Irish Mag claim the ore developments above the 650-ft. level are proving satisfactory, the orebody having been followed 60 ft. above this level. The new Powell shaft, which is being sunk at the rate of 140 ft. per month, is now 400 ft. deep. Drifting will probably begin on the 500-ft. level. Electric hoists have been ordered for both the Powell and Mag shafts. The Calumet & Arizona Co. is evidently anxious to increase its holdings, as its men are constantly examining new properties. Two of proven value have been found, one, at Courtland, furnishes smelting ore, and the other, near Mammoth, called the Copper Giant, supplies concentrating ore. In the Junction shaft of the Superior & Pittsburg Co., on the 1200-ft. level, oxide ore, the first found in this shaft below the 900-ft. level, has recently been found. The strike is considered important. On the 1400-ft. level, both north and south of the shaft, high-grade sulphide orebodies have been recently found. The Hoatson continues to be the largest producer of this company. The drift on the 1400-ft. level is being driven under the large orebody mined at 1300 ft. About 1000 ft. west of the Cole shaft a body of oxide ore has been developed, and cut through for more than 150 ft. At the Copper Queen all ore is now being hoisted through the New Sacramento shaft except a small amount from below the 1200-ft. level in the Lowell. The cost of fuel has been enormously decreased since the hoisting has been centralized at this one shaft. J. M. Boutwell, formerly of the U. S. Geological Survey, has been making a very careful geological study of the property since last October, both on the surface and underground. This examination is nearing a close. Important results are expected from his work. W. C. McBride, formerly superintendent of the Sierra de Cobre mine in Cananea, one of the Phelps-Dodge properties, has recently been made general manager of the Great Western mine at Courtland, replacing J. H. Talbot. As far as developments have gone, the Great Western promises to be the best mine in the Courtland district. It is expected that the Mexico & Colorado railroad will reach Courtland by the first of July.

GOLDFIELD, NEVADA.

Lucky Boy.—Combination and Fraction.—Florence Goldfield.—Copper Ore Shipped.—C. O. D.

The new vein opened from the Red Top workings of the Lucky Boy claim has been followed for a distance of 60 ft., and shows a fact of 10 ft. of ore yielding from $50 to $60 per ton. This ground is being timbered with square sets, and preparations are being made for extensive stoping. The 20-ft. stope at the 600-ft. level of the Mohawk, near the line of the Jumbo, is in a large body of ore of excellent quality which has been proved for 150 ft. A heavy tonnage is being broken from the new Hampton stope of the Combination mine, where the square sets extend for 45 ft. and involve intricate engineering problems. It is announced that work is to be resumed on the Laguna at a point where a vein of good ore was cut at a depth of 718 ft. in the Hazel lease. The Combination Fraction is making a splendid extraction of ore and is treating an average of 90 tons daily at the Nevada Goldfield mill, the average recovery being about $50.

Development in the Florence Goldfield mine has lately brought to light some new orebodies that compare favorably with the best that property has yet shown. Near the workings of the Little Florence lease, and immediately under the sugar-loaf hill, a vein has been opened at a depth of 200 ft., from which several shipments of high-grade ore have been taken. Sampling across 12 ft. returned $260 per ton. The orebody has been opened for 50 ft. in the stope and will be attacked shortly from another cross-cut 100 ft. deeper. This is oxidized ore in which the gold is not visible. On the same level and near the workings of the Engineers' lease the vein which appeared two weeks ago as a seam of high-grade ore has now developed in the raise into 7 ft. of ore of shipping quality, with 2½ ft. of exceedingly rich stuff in which the gold can be plainly seen. On the sixth, or 300-ft. level, another vein carries 6 ft. of good milling ore, and nearly under the old stope from which George Wingfield and associates took a fortune in high-grade ore in the early days of the camp, another raise has exposed 10 ft. of $80 ore. The mill is still handling ore of low grade, not over $30 per ton at best, and will not begin on the richer ore until the connections are made with the company's shaft. Further sinking in the Daisy mine has been temporarily suspended, and efforts are being directed to opening the ore-shoots at the 500-ft. level, where a station has been cut. The shaft was sunk below the 500-ft. level, and a sump of sufficient depth put down to handle the water. Development is also in progress at the 300 and 400-ft. levels, and daily shipments averaging 10 tons of $150 ore are being sent to the samplers. Late reports of a discovery of ore on the Great Bend have been exaggerated in the local press, and are emphatically

denied by the officials of the company. An assay was secured, in sampling a stringer exposed in the shaft of the Loftus-Davis lease, which ran $128 in gold, but there has been no duplicate, and the best the property has to show is a large vein of low-grade ore.

The first shipment of copper ore in the history of Goldfield was sent to the smelter recently from the Gold Bar workings on the C. O. D. Consolidated. A local sampling of the consignment showed the presence of 10 to 20% copper and probably not less than $100 per ton in gold. Mining has been deferred until the shaft shall have been sunk another 100 ft. from the 300-ft. level. The vein will shortly be penetrated at a depth of 600 ft. from the lease shaft of the Nevada Gold Ore Mines Co., also on the Gold Bar claim. This orebody is more than one-half mile south of the Florence or of any producing mine in the district, and the work is of particular interest from the fact that it extends the proved area thus far. Within a short period Manager Koontz of the C. O. D. has shipped ore from this shaft to the value of $15,000, all having been taken out in the course of development.

LONDON.

Tharsis Sulphur.—San Domingos.—Jumpers Deep.— Mount Boppy.

The Tharsis Sulphur & Copper Co. in Spain depends less on its copper production than many similar ventures, but none the less it is worthy of note that the dividend during 1908 did not fall below that of 1907, being £156,250, equivalent to 12½% both years. The Tharsis mine does not produce much pyrite, the bulk of the output coming from the Calañas mine. The total shipments of pyrite, washed and raw, amounted to 418,833 tons and the production of copper was 4427 tons. The company has been in existence for over 40 years, and the ore deposits are showing signs of depletion. The company has been investigating properties in all parts of the world, but so far without purchase. The owners of proved properties, knowing that the company has a million and a quarter pounds of cash in its coffers invariably ask for a bigger purchase price than the canny Scotsmen in control are prepared to give. On the other hand, development on prospects undertaken by the company has not yet yielded adequate results. Two properties in Arizona have recently received attention. One of them has been abandoned, and the other, while showing a fair amount of ore, has not yet proved worthy of operations on a large scale. Another pyrite mine in the South of Spain district, though the mine is actually over the border of Portugal, is the San Domingos belonging to the Mason & Barry. This is also showing signs of exhaustion. Instead of accumulating large funds in cash to represent the nominal capital, as has been done by the Tharsis, this company has from time to time distributed extra dividends. Altogether four-fifths of the capital has been returned in this way. The amount of ore extracted and the yield of copper are small compared with the old days, and sulphur is chiefly relied on nowadays for the profit. Less ore is now being placed on the cementation floors, as may be seen from the fact that the ore mined in 1908 was 293,172 tons and the amount sold was 340,439 tons. The profit at the mine for the year was £43,762. Interest on investments brought the total up to £56,701, out of which a dividend at the rate of 30% was paid, being the same as in the previous year. It is not possible to state how long the mine will last, but probably five years is the limit. The mine formerly yielded large profits and it has always been managed and operated with conspicuous business ability.

The prospects of the Jumpers Deep are so good that G. E. Webber recommends an increase of 80 stamps in the mill, bringing the number up to 180. He also recommends 3 more tube-mills, making 5 altogether. The capacity of the mill will then be 42,000 tons per month. In order to provide this new plant and to convert the driving appliances from steam to electric, besides installing a new hoisting plant, it will be necessary to spend £189,500. In the old days the probability is that 60,000 new shares of nominal value of £1 would have been issued at £3. Now, however, the altered methods of finance demand that funds should be provided out of income. Accordingly £60,249 cash balance in hand will be applied immediately and no interim dividend will be paid. The remaining £129,251 will be provided out of the revenues during the next few years, so that dividends will be temporarily reduced; that is to say, the dividend for the year ending September 30, 1909, will be 5%, a similar sum for the succeeding year, 7½% for the year ending September 30, 1911, and 10% for the year ending September 30, 1912. The whole of the expenditure will then have been provided for and afterward the dividends will probably be about 20 per cent.

The Mount Boppy gold mine in New South Wales owes its success mainly to the late Frank Taylor, head of the firm of John Taylor & Sons. It happened that the property was ready for flotation in November 1899, just as hostilities broke out in South Africa. At that time there seemed little hope of floating anything but a war loan. Mr. Taylor promptly subscribed a large part of the working capital needed for the mine, and in that way made the scheme a success. A few years afterward he also subscribed liberally for capital required for extensions. The mine has fully justified his expectations and has done well for its shareholders. Dividends commenced in 1902 and for the last five years have averaged 45% on a capital of £121,000. During 1908 the profit was £68,228, out of which £57,475 was distributed. The ore treated was 69,557 tons, yielding 34,136 oz. of fine gold, which is practically 10 dwt. per ton. It is estimated that the ore reserves on December 31 last were 126,850 tons, though James Negus, the manager, points out that these figures are necessarily speculative, owing to the irregularities in the width and contents of the veins. The ore consists partly of free-milling oxidized ore and partly of sulphides, and 30 stamps are treating each kind of ore. Additional plant has recently been provided for dealing with the sulphides, such as grinding pans and roasting furnaces. The extra expenditure in this direction has increased the costs, but, on the other hand, has greatly increased the extraction.

PIOCHE, NEVADA.

Day Mine.—Bristol Consolidated. — Prince Consolidated — Pioche King.—Railway Rumors.

The long-promised era of larger shipments from Pioche appears to be at hand. A few weeks ago the Nevada Utah opened another kidney of ore in the Day mine. In this property a system of fissuring in Cambrian limestone runs southwest through the Cottontail, Coyote, and Hillside. The Day and the Hillside have a record of production running into the millions. The Hillside was discovered in 1871. The Nevada Utah has never taken any steps to re-open and operate it, and its old workings in their present condition cannot be safely inspected. At Bristol, five miles from the Hillside, are the ruins of a Washoe mill and two smelters. Bristol at one time had a population of over 500 people. The operations of these plants covered a period of more than 10 years. We know that the Hillside furnished a large proportion of the ore treated, and the enormous dumps at the mine testify to extensive mining, but no one seems to have any full understanding of the nature and size of the orebodies. The Day mine was located in 1877. The first 500 tons extracted are said to have yielded upward of 500 oz. silver to the ton. Day worked this and connecting orebodies down to the sixth level and for hundreds of feet in length. He found them varying widely in size and shape, and extending out from the fissures into the limestone. The fissures themselves carried little ore. The orebody recently opened has been followed from a little above the eighth to the sixth level, where Day missed it by less than 5 ft. The opening on it is already more than 200 ft. long, with a maximum width of 75 ft., and a proved vertical height of 150 ft. Its limits have not been defined, but Mr. Gaskill, the manager, says that it has been explored sufficiently to warrant the statement that it is the largest single orebody ever opened in the mine. Ore-bins of 300 tons capacity have been built at Pioche. A new engine has been ordered for the narrow-gauge railroad from the mine to the station here. The

present equipment is only adequate for a daily output of 250 tons, which can now be mined and maintained indefinitely. Thus far shipments have been restricted to an average of 70 tons per day, because the A. S. & R. Co. at Salt Lake has declined to accept more. Arrangements are now virtually perfected to begin shipping 200 tons per day. It is too early yet to predict what the average tenor of the new orebody will be. Much of the ore contains chloride and bromide of silver. Returns thus far have shown from 18 to 30 oz. silver per ton, with sufficient excess iron and lime to more than cover cost of transportation to the smelter. The ore is put on cars at Pioche at a cost of 90c., including office expenses. Below the 800-ft. level, and for over 300 ft. toward the Hillside, the ground is still unexplored, and Mr. Gaskill intends to continue developments in both directions.

The recent conference between executive officers of the Nevada Utah and the Ohio Kentucky failed to unravel the tangle in titles in which these companies are involved. Conferences were resumed at Salt Lake, and the question is understood to be still open in New York. The mines of the Bristol Consolidated, which lie below the Hillside on the western slope of the range, have been operated only by lessees during the past 5 months. The Mayday and Gypsey of this company, the only mines equipped with hoists, were closed by W. C. Brace, the manager, when he went to New York last fall. Five sets of lessees have been working with the crudest of prospecting apparatus on other mines which the company has never attempted to re-open, but all of which produced much good ore in former days. From 25 to 30 cars of high-grade copper and lead ores have been produced, a considerable part of which has not yet been brought in, because of deep snow on the hillside or deep mud on the roads. In the Prince Consolidated attention has been devoted to the high-grade fissure veins which cut transversely through the formation and are generally referred to as vertical fissures. They have been opened more than 500 ft. along the strike and on the 550-ft. level proved to be fully as strong as on the 300 and 400. Recently the company has been doing a little stoping on these veins. Several cars have been shipped. In addition to the vertical fissures are highly mineralized beds conformable to the bedding planes. One of them, cut in the shaft a little above the 550-ft. level, was 18 ft. thick. After the roads became bad the Mendha cut down its shipments to a car a week, about enough to pay expenses. The production in recent months has all come from the bedded veins. The ore still runs well in gold, with 15 to 25% lead and about 1 oz. silver to each unit of lead. The bedded veins in places have been over 8 ft. thick. Only ore extracted in course of development has been shipped. In the Ely Valley prospecting crosscuts are being pushed on the 300-ft. level to the northeast and southwest. Four known veins are expected to be cut at this level. Considerable first-class ore has been developed, running up to $10 per ton in gold, 30 oz. silver, and 20% lead. It has not been the policy of the company to ship, the officers believing that lead and silver will soon advance in price. The Boston & Pioche has been steadily sinking its main shaft on the old Yuba East. A cross-cut from this shaft on the 800-ft. level recently cut the ore, which was found to be of the same high character as that found in the upper levels. To the north of the Prince Consolidated lie the Pioche King, the Golden Prince, and the Gold and Silver Prince. Each hopes to catch the Prince orebodies. The two former are already equipped with machinery for hoisting and air-compression, and the latter has its machinery on the ground. The Pioche King was organized by John A. Kirby, the well known mine-manager of Utah and Nevada, and one of the largest owners in Nevada Hills.

One of the most important factors bearing upon the future of this section is the increasing assurance of a railroad to Ely. The purchase by the Cole-Ryan combination of control in the Giroux, and the financing of the Goldfield-Ely railroad, tend to confirm the statement so often heard of late that Ely is to be made one of the great smelting points in the West. Ely must have Pioche ores for fluxes, if much smelting is to be done. It is stated that the road is to be built south from Ely and is to be closely allied with the Ely Northern. This would give Pioche a competing line to Salt Lake City. Other information is to the effect that the Salt Lake line is anxiously watching the situation, with a view to building from Pioche to Ely. This would give Los Angeles a line to Ely by way of Pioche, as well as Goldfield, and would give Ely a competing line to Salt Lake City.

WHITE HORSE, YUKON TERRITORY.

Cold Winter.—Burwash Creek.—Copper King.—Valerie. — Railway and Smelter Changes.—Conrad Consolidated.

Owing to the present low price of copper, little work has been done during the past winter in the White Horse district; the severe winter has also had its effect. Beginning soon after Christmas, the weather settled in cold and remained so until well along in February. It is claimed that during this time the average degree of cold was 30 below zero. In spite of this cold weather, a pay-streak was discovered, and is reported to have been traced about 4 miles on Burwash creek, a tributary of the Kluanie river, 100 miles west of White Horse. The pay was found in an old channel of the creek, the bedrock of which is slightly above that of the present bed. Pannings average from 3 to 4c. per pan, or about $2 to the bucket. For a depth of 5 ft. above bedrock, the pannings on bedrock are said to be considerably better. The pay is believed to be at least 60 ft. wide. If future work proves these conditions, the creek will become a great producer; it is however too soon to give any accurate estimate of its real worth. Among the most promising copper properties in the immediate vicinity of White Horse, is the Copper King. On this property work has been carried on all winter, and some 400 tons of ore have been shipped to the Tyee smelter on Vancouver Island. This ore is said to have run 15% in copper and 2½ oz. in silver, with a small amount of gold. The property belongs to J. C. Whitney and W. C. Pedlar, of White Horse, and to the estates of W. P. Granger and John C. McIntire. At the present time Thomas Guffy of Pittsburg, and associates, have a bond on the property. Harry Baxter is the local manager. His address is White Horse, Y. T. Much is expected of this property in the future.

On the Valerie, considerable development work has been under way this winter, and a good body of ore has been exposed, which is said to run 15% copper. There is a large amount of possible ore in this mine. It is owned by A. B. Palmer of Vancouver, B. C. A spur seven miles long has been built by the White Pass R. R. Co. This track leaves the main line a little south of White Horse, and reaches most of the properties of note. It is understood that a revision of rates is being planned which when complete will permit most of the mines to ship their ore to the smelter. The railroad company has also erected large ore-bins equipped with chutes at Skagway. This will facilitate the loading of the vessels that carry the ore to the smelter. These improvements have cost the White Pass R. R. Co. fully half a million dollars. There is talk of the Tyee Smelting Co. putting up a plant at some point near White Horse.

The Conrad Consolidated Mines is on Windy Arm, which is a neck of Lake Tagish, Y. T., some 25 miles east of Caribou, on the White Pass railway. J. H. Conrad is president of this company. Work has been going all winter on the Venus claim, where a 50-ton concentrating plant has lately been completed. Good results have been obtained. The concentrates are shipped to the smelter for reduction. The property is now on a successful basis, due in a great measure to W. H. Vance, the superintendent, whose address is Windy Arm, Y. T. The Big Thing is another property on Windy Arm, in which J. H. Conrad and some associates from Toronto are interested. Last winter a body of high-grade ore was struck. It is reported worth $40 per ton gold, besides having a high silver content. The strike has caused a good deal of excitement. At present 100 tons of this ore is at Caribou, ready for shipment to the smelter. W. H. Vance has charge of this property.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Coal-fired furnaces yield the highest heat-efficiency when the stoking is done at frequent intervals, using light charges.

California magnesite is equal if not superior to the Hungarian in quality. Owing, however, to it occurring here in smaller veins, to the higher wages prevailing, and to the long railway haul, the local material does not reach the Eastern market. There is no tariff on magnesite.

Zinc-dust is composed of metallic zinc coated by a film of oxide. It forms readily by dilution of volatilized zinc, and condenses as a powder in particles so small that they cannot coalesce to form a liquid. Formerly a source of loss to zinc smelters, it has become a valuable by-product.

Ochre is prepared for the market by fine-grinding and sizing. Occasionally it is given a light roast to perfect the color. It is sold mainly to paint grinders and to manufacturers of linoleum and oil-cloth. Approximately 16,000 tons per year are now marketed in the United States, at an average price of $10.

Pitchstone is a variety of obsidian in which the rock is dull and opaque, appearing glassy only on thin edges. It resembles an over-limed iron-furnace slag. It often possesses a resinous appearance, whence its name. It varies in color from black to gray, and is sometimes red, brown, and not infrequently green. It contains from 5 to 6% moisture.

Boiler-waters are often softened by the use of fats, which combine with the lime and magnesia to form soapy compounds. It should not be forgotten that these attach themselves to the plates and, having a lower conductivity than calcium sulphate, increase the danger of over-heating and explosion. When petroleum is used compounds having corrosive properties are formed.

Miarolitic structure is a term applied to open spaces or vugs in crystalline rocks, usually drusy from the development of crystals free from interference. The open spaces are the product of contraction during the solidification of a rock from the condition of a fused magma. Miarolitic cavities must not be confounded with geodes and drusy cavities in which the crystals have been subsequently deposited from solution.

Assay-ton is the name given to a weight of 29.166 gm., which is $^1/_{1000}$ of the number of troy ounces in a ton of 2000 lb. If a sample of 1 assay-ton is taken and the resulting bead weighed in milligrams, each milligram represents 1 oz. per ton. Should it be required to weigh the pulp in grams, the following principle will be found useful: 29,166 oz. troy is equivalent to 1 ton. The value of 1 oz. pure gold is $20.67. Therefore 29,166 oz., or 1 ton, equals $602,861. If 100 gm. is taken for a sample and the bead weighed in milligrams, then from the proportion 1 mg. : 100,000 mg. (100 gm.) = x : $602,861, each milligram represents $6 per ton.

Garnet is frequently found in the contact zones between eruptive and sedimentary rocks. In such situations it is evidence of contact metamorphism, and sometimes accompanies deposits of copper. In New York, Pennsylvania, and North Carolina it is quarried and mined for use as an abrasive. For such purposes it is worth approximately $30 per ton cleaned and delivered in New York. About 7000 tons per year are marketed.

One hundred per cent dynamite is a misnomer, and a most crude one at that, for blasting gelatine, which is a mixture made by dissolving guncotton in nitroglycerine. The term erroneously applied to this explosive would, if properly used, mean nitroglycerine alone. Dynamites are graded according to the amount of nitroglycerine absorbed in the dope, expressed in percentages. The highest grade manufactured for railroad transport is 60%, but 70% dynamite is made for shipment by sea.

Phosphor-bronze is employed in situations where resistance to corrosion, coupled with great strength, is required, as in pumps for mine-waters. It is composed of copper, tin, and phosphor-tin, the latter being an alloy containing 5% phosphorus. The phosphorus is added to reduce the metallic oxides, thus toughening the metal. A good acid-resisting phosphor-bronze consists of copper 90, tin 9.8, and phosphorus 0.2%. The tensile strength of the alloy is from 40,000 to 50,000 lb. per square inch.

Lead-covered conductors for electricity are the best in all wet situations, and should be used in shafts. The lead covering is a protection against chemical action and mechanical injury. It is further advantageous to protect the lead-sheathed cable with wooden cleats, or to box it to prevent accident. The branch cables at the various levels are connected by ordinary branch-joints. High-grade rubber-insulated cable may be used in metal mines, in which case extra precautions against injury should be taken. Boxing the cable will usually suffice.

Iron-ore reserves have been variously estimated by different statisticians, and have given rise to controversy, but the essential significance of the estimates, in which there is general agreement, is that the large reserves of metallic iron in the ore credited to Germany and Great Britain are actually unavailable at present, on account of the competition from high-grade reserves in America, Spain, and Sweden. The American ores range from 45 to 67% Fe, and those of Spain from 40 to 56. The attack for commercial uses is upon the high-grade deposits first. Estimates of the world's supply of iron will have more significance after the depletion of the reserves in America has brought her to the condition of England and Germany.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mechanical Elevator in Hydraulic Mining.

The Editor:

Sir—In the MINING AND SCIENTIFIC PRESS of April 10 you mention a mechanical elevator made for George H. Evans of the Gold Pan Mining Co. at this place. I wish to state that there was such a mechanical elevator made and shipped here, but it was never installed. I believe, and have always believed, that a mechanical elevator would be the proper machinery to work such ground as the Gold Pan, or any that has large boulders to any great extent. The use of a mechanical elevator will allow the bedrock to be cleaned up while dry.

T. A. BROWN.

Breckenridge, April 17.

Eight-Hour Legislation.

The Editor:

Sir—The article published in your issue of April 17 upon 'Eight-Hour Legislation' is admirably written and carefully thought out; but it does not mention an important feature of the Utah case, namely, that by the constitution of that State it is specially enjoined upon the legislature as one of its duties to pass laws to provide for the health and safety of employees in factories, smelters, and mines, and it is therefore not to be wondered that, in the case you refer to of Holden *v.* Hardy, the law was held to be valid under the Utah constitution.

Also you do not refer to the case of Colorado, in which it was finally decided that the eight-hour law for mines and smelters violated the constitution of that State, which constitution inhibits class-legislation. I need not cite the many provisos in the constitution of California, such as Art. 1, Sec. 1, 11, 13, 21; and Art. 12, Sec. 25, which protect citizens against interference with their liberty of contract or against class and discriminatory legislation; but in view of these facts it would not appear that the Utah case can be held as a precedent, and I suggest there is reason to believe that the eight-hour law known as Assembly Bill No. 445 might be declared to be opposed to the constitution of California.

LEWIS T. WRIGHT.

San Francisco, April 20.

Colombian Health Conditions.

The Editor:

Sir—In an article on 'Economic Conditions in Colombia' in your issue of April 17, F. Lynwood Garrison gives as the seventh class of malarial fevers treated by the physicians of the Canal Zone during the year 1898, "Hemoglobinuric fever—discharged 29—died 11," and as the fifth in his classification he names "pernicious malaria, the deadly blackwater fever, known scientifically as *laverania malariae*." He further writes, "I have heard of some cases of the deadly 'blackwater fever' in Jamaica, but none in Panama or Colombia, although, like the beri-beri, if once introduced it may be difficult to stamp out under favorable conditions for its propagation. The blackwater fever is common in Africa, just as beri-beri is in China and Japan."

In Africa the blackwater fever, sometimes also called hematuric fever or hematuria, is the hemoglobinuric fever (hemoglobin in the urine). It may be a trifle strong to speak of it being 'common' there, yet in all the region north of the Rand it certainly is sufficiently prevalent to make it a thing to be dreaded, and the proportion of deaths in cases treated at Panama, about 1 in 3, is similar to that where patients are cared for in African hospitals. Out in the bush, away from good nursing, the percentage of fatalities is much larger, and in any tropical country where this dreaded malady exists it should, and must, be of serious consideration for men going to prospect or mine.

The disease is so little understood that it is difficult to obtain much accurate information about it. In his book, 'The Truth About the Congo,' Prof. Frederick Starr says: "The disadvantage of this constant dosing with quinine is the danger of the dreaded hematuric fever. This dread disease rarely attacks a person until he has been a year in the Congo. It is commonly attributed to the system being loaded up with quinine. The instant that its symptoms develop the order to cease taking quinine is issued. Among the European population of the Congo, hematuric fever is regularly expected to have a fatal issue. It is more than probable that the use of wines, beers, and liquors predisposes the system to fatal result. Plenty of missionaries die of hematuric fever also, but the appearance of the disease among them by no means produces the panic that it does among Continentals. Perhaps one in five or six cases will die, two of the remainder will flee to Europe, the other three may recover; but the disease is no trifling matter, and must be seriously taken."

The idea that the continuous taking of quinine causes 'blackwater' is prevalent in Africa, but the weight of British authority is to the contrary. It is also often claimed to result from frequent attacks of malaria, but the better opinion leans to the belief that frequent attacks merely weaken the system so as to make resistance to hematuria feeble. It is also known that the disease is not likely to come until after a year or more has been spent in the country, but instances are not infrequent where newcomers have been victims. It afflicts the young and vigorous (and that, too, sometimes when they are feeling 'extra fit'), rather than those of more mature years. Quinine appears to aggravate the malady, and must not be given. "Favorable conditions for its propagation" are unknown, as it is neither contagious nor epidemic; it is rather endemic, and appears to come sometimes in waves over a district. It occurs in depressed or basin areas at high altitudes as frequently as in low-lying regions. As the cause of it is unknown, no specific has yet been found.

In malarial fever there is a somewhat gradual

breaking up of the red corpuscles of the blood, in the manner described by Mr. Garrison. Black-water fever comes from the rapid destruction of these red corpuscles, and as the system endeavors to cast off the dead discs in every way, it is essential to keep all passages open, more especially the kidneys, which may become clogged, leading to agonizing and fatal results. It is also of the utmost importance to prevent collapse, and the best stimulant, practically the only one that the stomach will retain, is champagne, administered slowly by teaspoonfuls. All well-equipped parties traveling in Central Africa carry champagne as a precious medicine for this purpose, with prayers that it may never have to be used.

J. R. Farrell.

Oakland, California, April 19.

What Is an Ore?

The Editor:

Sir—If you insist on publishing articles provoking discussion, you must suffer the penalty. Concerning 'What Is an Ore?' in your issue of March 20, I must say, in the first place, 'ore' is a term which properly has no 'mineralogical sense'. It is purely a commercial term, and therefore affects only the miner and the metallurgist. Generally speaking, it would seem best to define an ore as any natural earthy product containing free or combined metal or metals which can be mined and treated at a profit for any metal or metals therein. It cannot be ore to the miner and waste to the metallurgist, or vice versa, since its definition as 'ore' is a function of any profit derivable after deducting the total cost of handling.

F. C. Smith.

Sault Ste. Marie, Ontario, April 17.

Protection of Investors.

The Editor:

Sir—As the discussion of this subject progresses, under the auspices of the Mining and Metallurgical Society of America, the chief elements of danger have become well defined. We have an expression of opinion as to items of information to be given by mining companies for the guidance of stockholders. These are, in brief, the commercial history of the enterprise, its present financial condition, a detailed statement of ore-reserves, an estimate of the probable life of the mine, and a valuation of the property.

The classification of ore-reserves has been freely discussed and generally agreed upon. To estimate the life of a property is, admittedly, a matter of greater complexity. To calculate the value of ore available and blocked for stoping is not difficult. To determine the time necessary to exhaust orebodies already blocked is relatively simple. To successfully estimate the possibilities of undeveloped ore requires wide geological experience and discriminating judgment. To form a safe forecast of ore as yet undiscovered is always difficult, and in some cases beyond the range of human power. Yet all four of these operations are involved in estimating the life and value of a mine.

In an established district, where some mines have already attained substantial depth and many of the more important factors are known, and especially where the ore has some regularity of occurrence, one may, with fair hope of accuracy, base an estimate of the life of a new mine on facts developed in a neighboring property. But in a newly opened area of mineralization, a pioneer mine is often wholly in the prospect stage with regard to its possibilities beyond the ore actually blocked, and one of its assets is the geologic promise of continuous or extensive mineralization. The extent to which this must remain an unknown quantity depends upon the amount of money available for development in advance of actual mining.

While we agree on the need of protection for investors, and of information tending to achieve this end, there seems to be a disposition on the part of some contributors to consider only the protection of investors in producing mines. It is obvious that a mine is rarely productive at the start. It normally has to pass through the prospect stage before reserves can be developed, and sometimes the reserves become exhausted and the mine reverts to the condition of a prospect; so it seems as if we were avoiding the discussion of mine management in the prospect stage, when many properties are temporarily injured by bad work, and offering help to investors only when a property has weathered the storm of uncertainty and cast anchor in the harbor of ore blocked. Nearly all mines that are now producing had stockholders while they were being tested as prospects, and stockholders in prospects are often quite respectable people and deserve all the help they can get.

Since the mining industry would come to an end if development of prospects should cease, I think it is wrong to confine the discussion to the administration of productive mines and to leave the public to conclude that prospects are in any sense illegitimate. It would be quite as logical to continuously refer in terms of contempt to children. Just as 'the child is father to the man', so is the prospect father to the mine. The mortality among prospects is probably no greater than among children, and failures in mining are no greater than in ordinary business pursuits, where only 2% achieve success. Further, the salesman's tricks used in disposing of mining stock are used in selling many other commodities.

We want to make the public acquainted with the tricks of unscrupulous people, but we do not want them to imagine that any of the different stages of the mining industry are not proper channels for financial venture if in honest and competent hands. There will always be persons who cannot afford to invest money in any business which involves risk; for such persons there are numerous investments which yield a small but safe income. On the other hand, there will always be persons, in active business life, who make more than they need for current expenses and like the excitement of putting money into new ventures. For such persons mining, under competent technical advice, is as safe an outlet for surplus funds as the common activity of real estate speculation, or as some branches of agriculture, which in many portions of the country are well

known to be a gamble against weather and climate, with further difficulties in connection with transportation and manipulated markets.

As I view the situation, the difficulty is not so much with the risk in mining as with the ways in which money may be raised in the name of mining, and with the way in which it is spent by unscrupulous persons. Many promoters raise money on a mining enterprise, not to benefit the stockholders, but to pay themselves a salary and to absorb a part of the money for expenses. But the same thing is done in other kinds of business.

When a mine has reached the degree of development which proves the existence of a substantial orebody, its owners are usually anxious to raise money for equipment, and sometimes are willing to sell and enjoy a moderate reward for their labor and risk. If it happen that they have not the necessary financial connections to raise money through a syndicate or close corporation, the promoter comes in to do the work of raising the needed money. The mine may have a half million dollars' worth of ore blocked, and perhaps $200,000 may be needed to erect a reduction plant and to provide working capital. The promoter, if he is unscrupulous, forms a corporation with a capital of from one to ten millions, takes 40 to 60% of the stock for promotion profits and expenses, and sells a certain amount of the remainder at a fraction of its par value in order to raise the necessary cash for the mine equipment. He makes his profit by selling his personal stock. His theory is that stock offered at a small fraction of its face value seems a better bargain to the average purchaser, and so a large amount of stock is sold to raise a relatively small amount of money. Sometimes stock is sold under pretense of underwriting by some trust company. For example, a brokerage firm in the East offers to sell on commission any mining stock entrusted to it, provided the stock be underwritten by a certain trust company in the West. The underwriting company is usually willing to underwrite anything for a consideration, and its guarantee is often flimsy, and essentially worthless as a protection to the purchaser of the stock.

In conclusion it must be said that frenzied finance, over-capitalization, and serious financial blunders are not confined to mining companies, and that neither the mining industry nor mining engineers should assume or be allowed to bear a stigma which is undeserved. Mining, properly handled, is as safe as any other commercial industry.

F. J. H. Merrill.

Nogales, Arizona, April 17.

The Engineer as a Financier.

The Editor:

Sir—Protection of investors and the function of the engineer as a financier are so slosely connected that it is surprising that no one has correlated the two. With the engineer acting also as a financier, there can be no protection to investors, for the financier is looking toward his own gain at the expense of the investors. An engineer who deals in the stocks of any corporation with which he is connected, or who accepts the promise of a fee should his report be favorable and a sale be made, is, in my opinion, violating profesisonal etiquette. But we are considering mining, and particularly gold mining, in which there is no professional etiquette, for the mining engineer has no legal status. All that seems to be required is a pair of high boots and a suit of corduroys, and as for the superintendent, his qualifications are to be a friend or relative of the promoter, or the president of the company. This is not said in jest; it is a fact of frequent observation.

How can the investor be protected by law unless his agents have some lawful standing. Because one can cure a cold or bind a wound is no sufficient qualification for a doctor. Because one can interpret commercial or common law, does not make one a lawyer; but anyone who leases, promotes, finances, or mismanages a mine, may call himself a mining engineer and is liable to be taken at his own rating.

One of your correspondents some time ago remarked that without the wild-catter, the promoter, and the fake mining engineer, large tracts of country now occupied and inhabited would still be dreary wastes. Perhaps he was right, but the question is, has or has not the time come for a different order of doing business? If so, how can it be done? It would be useless to fix by legislation who is a mining engineer, for this has never been attempted, although in Europe it is generally understood that a man must have received a technical education in a mining school. In this country it is otherwise. The legislature, however, could pass a law defining the qualifications of a mine superintendent or a mine manager, and make compulsory the issuing of definite reports, and compel the company's officials to post these reports in a conspicuous place in 'their office', or if the office is not in the State, then at the shaft or office at the mine, so that it would be public property. Superintendents as a rule give all necessary data to the office, but the officials for their own purposes do not give out these reports. If the managers were compelled to give certain facts, and if the officials were compelled to make them public, the investor would be well protected. It might be a good idea to have monthly reports registered with the County Recorder.

Some years ago I applied, in answer to an advertisement for desk-room in a lawyer's office. I stated that I was a mining engineer. I was politely shown the door with the remark that "to have a mining engineer in my office would ruin my business." And that from a lawyer!

Some of us younger members of the profession have had a rather rude awakening lately. Our alma mater had drilled into us the idea of being a man first, and above all things to play the game of life fair. We now see those whom we had looked upon as being at the top of the profession acting as nothing but 'money grubbers'. We see them lending their names to make a market value for stocks. What are we to do? Play the game fair! If integrity does not lead to the top, then peg away in the mill, the mine, or the cyanide plant, and still remain a man.

Algernon Del Mar.

South Pasadena, California, April 10.

CYANIDATION AT MERCUR, UTAH.

Written for the MINING AND SCIENTIFIC PRESS
By LEROY A. PALMER.

The first cyanide mill in the Western Hemisphere was built at the Mercur mine, in Utah. The Consolidated Mercur, successor to the original company, built what was for a number of years the largest straight cyanide plant in the world. The development of the process for this company forms an interesting chapter in this branch of metallurgy, and although larger plants have since been erected, many textbooks still devote space to Mercur practice as exemplifying the most successful method of treating certain classes of ores.

The ore in this district is porous and friable, prone to slime excessively, and it causes much trouble on this account. In fact, the first attempts at cyaniding were a flat failure, because, when crushed to the size supposed to be necessary, the pulp formed a thick slimy mud which the solutions absolutely refused to penetrate. Slime has always been troublesome. Recently an extensive slime-plant, embodying many new features, has been installed, and has brought the problem nearer to a satisfactory solution than hitherto. The mine furnishes two classes of ore, one oxidized, and the other base, owing to the presence of sulphur and arsenic. These two classes are broken separately, and dumped into different pockets at the Golden Gate incline, where they are hoisted to the crude-ore bins in two 4-ton skips, working in balance. These bins are of steel, well braced by steel beams and columns.

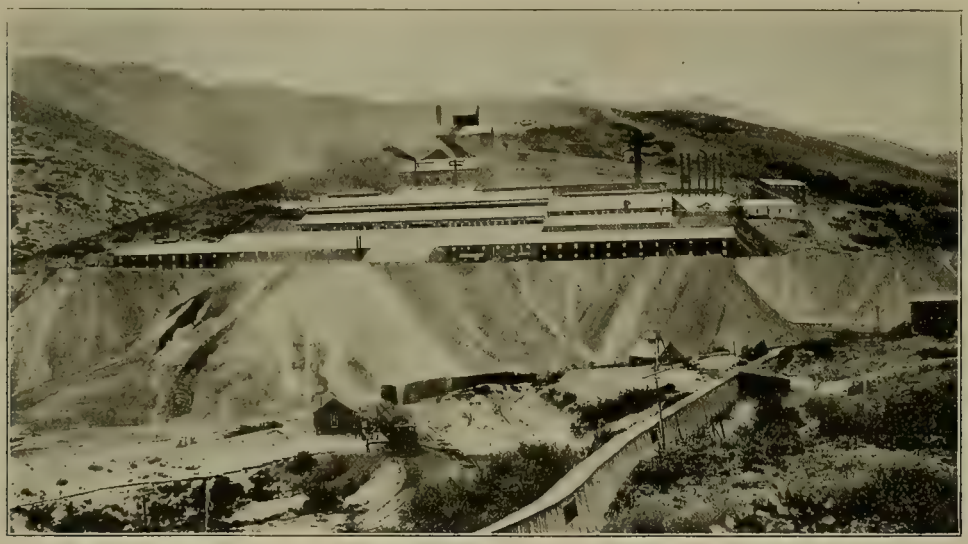
The progress of the base ore through the mill is as follows: Passing over a grizzley the oversize goes to a No. 6 Gates gyratory crusher, which reduces it to pieces that will pass a 3-in. ring, and discharges to the crushed-ore bin beneath. To effect distribution in the bin the crusher-discharge can be turned into a bucket elevator, dumping to a chute that sends it to the farther end of the bin. In the front of the crushed-ore bin are seven gates, through which the ore discharges into a chute leading to a large hopper set over an 18-in. inclined belt-conveyor, which carries the ore to a set of 14 by 36-in. Allis-Chalmers A (Gates) rolls. These rolls discharge to a second set of the same size, and those in turn to a third set, 14 by 24 in. The third set discharges to the No. 1 elevator, which dumps to a wire-cloth trommel having three meshes to the inch, thus allowing a free opening of about ¼ in. The oversize from this trommel goes to a second, with openings three one way by one the other in each square inch, giving a free opening about ¼ by ⅞ in. The oversize from this trommel goes to a fourth set of rolls, 14 by 24 in., discharging to the No. 2 elevator, which dumps to the bin without screening. In the chute to each set of rolls is a screen of the same mesh as the second trommel. These take out the undersize, which goes to the No. 2 elevator. Owing to the nature of the ore, crushing is done dry. All other elevators are 14 in. with 6 by 14-in. cups, spaced 20 in. from centre to centre. The bins are all of steel, well reinforced by 9-in. I-beams placed both vertically and horizontally. Below the bins are three floors containing the roasters, five in number, three of the Jackling type, one Brown, and one Holthoff, each having a capacity of 70 tons. The crushed ore discharges through the steel gates to a conveyor running in front of the bins, which in turn discharges to a conveyor running at right angles and over the feed end of the furnaces, which are arranged two on a floor, except on the second floor, where there is only one. The base ore is discharged to a large hopper, from which it is fed to the furnace by plunger-feeders. The Jackling furnace, designed by D. C. Jackling, who is now manager for the Utah Copper Co., is the most successful of the three types, and embodies practically the same principles as the others. The furnace is of brick, with fire-brick lining, 100 ft. long, 16 ft. wide, and 3 ft. high at the sides, with an arched roof rising 8 in. An endless chain carries 6 beams with 22 scrapers. The scrapers keep the ore rabbled, and at the same time draw it slowly forward. On each side are two coal-fed fire-boxes in which a blast from a fan aids in maintaining the desired heat, and a steam-jet directs the flame downward upon the ore. The sides are well provided with cast-iron doors, permitting ready access to any part. By the time the ore has been dragged the length of the hearth, which is 10 ft., the sulphur and arsenic are all expelled, and the roasted ore is discharged, and is picked up by an elevator consisting of beams each of which carries five cups. This dumps it on the cooling platform, about one foot above the furnace. Here it is slowly scraped back, being turned and exposed to the air in the process, until just before it reaches the end at which it is fed it passes under a spray of water, and is discharged by a screw to the belts that carry it to the bin above the leaching floor. For the last fiscal year the cost of roasting, including maintenance and repairs, was $1.217 per ton. As will be seen later, this figure was made under disadvantages, including a fire which destroyed a large amount of coal, all of which was charged to the roasting department.

From the crude-ore bins on the oxidized side of the mill, the ore passes over a grizzley and through a No. 6 Gates crusher, reducing it to 3-in. size, and discharging to the crushed-ore bins. From these, 7 gates discharge to a hopper over an 18-in. horizontal conveyor which dumps to a set of 14 by 36-in. Allis-Chalmers A rolls, the product from which goes to a similar set of 14 by 24-in. rolls, discharging to the No. 1 elevator. This elevator dumps to a 3-mesh trommel, which sends the oversize and undersize to separate bins. In each roll-chute is a screen similar to those used on the base-ore side, and the undersize from these screens goes to the No. 2 elevator to be dumped with the fine ore. The coarser ore contains chunks as large as 1 in., but they are so porous that the solutions permeate them without difficulty, and it has been found that fully as good an extraction is made on these sizes as on the material more finely crushed. This coarse ore, ranging in size from ¼ to 1 in., is discharged through the gates to a conveyor parallel to the bin, which dumps to another running to a chute, terminating at a bin beside that which receives the roasted base ore. On the leaching floor

are 26 rectangular steel vats, 48 by 24 by 4 ft., with the usual cocoa matting and canvas filter-bottoms, and 8 circular discharge-openings, 12 in. diam., with drop doors underneath over a series of four parallel tramway tracks. The three stock-solution tanks set on the next floor above the vats give a good pressure for forcing solution from below, if necessary. Each stock-tank is circular, of steel, 20 ft. diam. by 12 ft. deep.

The leaching vats are charged by tramming from the bins, each vat being filled to a depth of 2 ft. with the coarse oxidized ore, and the remaining 2 ft. with the roasted fine. Thus the coarse ore forms a filter for the fine, allowing the solutions to percolate thoroughly without packing. The vat being filled, 1500 lb. of lime is sprinkled over the top, and a 2-lb. KCy solution is turned on from below. When this has covered the top it stands for a few hours before being drawn off. The usual practice of aerating is found to be a disadvantage, causing the ore to pack, and preventing the free circulation of the solutions. As fast as the solution is drawn from the bottom, more is run on the top, so as to keep the ore continually covered at a uniform depth. Two days after the strong solution is first turned on it is replaced by the weak wash (1 to 1½ lb. KCy per ton), and the charge is treated with this for three days. This is followed by a two days' treatment with wash-water, and the tanks are then discharged by shoveling through the doors to tram-cars, which are hauled to the dump by horses. The consumption of lime is 6.85 lb. and of cyanide 0.7 lb. per ton of ore treated. The strong solution, when drawn from the leaching vat, runs to an 18 by 12-ft. circular steel tank, from which it is pumped to three 14 by 8-ft. circular steel tanks, where zinc fume is added. The pumping serves to agitate the solution, and this is further accomplished by air under pressure from a simple 10 by 14-in. motor-driven Ingersoll-Sergeant compressor placed on the sump floor. The zinc-gold solution is drawn off to 11 Johnson filter-presses, each 7½ by 2 by 2 ft., the filtered solution from which runs to the sump and is pumped back to the weak-solution stock-tank. The zinc consumption is ⅓ lb. per ton of ore. Working beside the filter-presses is a standard type of zinc-box, 17 by 2½ by 3 ft., divided into 7 compartments. This was installed as an experiment, and has been so successful that the management is contemplating changing to this method of precipitation. The weak gold-solution is collected in an 18 by 12-ft. circular steel tank, and without precipitating the gold it is pumped back to the strong-solution stock-tank, and cyanide is added to bring it up to a strength of 2 lb. per ton. Two 5-in. geared Gould rotary pumps handle the solutions.

The slime-system is as follows: All oxidized ore that passes through the 3-mesh trommels goes into its own bin, and is drawn through the gates to be mixed at once with strong cyanide solution. This washes it to the separators and classifiers. The first stage is to pass it successively through two so-called 'mixer-separators'. Each of these consists of a box 20 by 3 by 3 ft., having a grade of one inch per foot. In the box is a longitudinal shaft, having two blades set every 6 in., similar to the blades of a ship's propeller. This shaft slowly revolves, working the ore upward as a screw-conveyor, while the solution tends to wash it toward the end of the box. The coarser particles offer sufficient resistance to the current to work out at the head of the box by the action of the screw, but the finer wash out of the opposite end to a second similar device, where the process is repeated. The separation of the coarse from the fine and the mixing of the latter with solution, gives the device its name. The tailing from the second 'mixer-separator' goes to a cone, and the overflow from this goes to the slime-tanks, and the settling discharges to two Dorr classifiers. The Dorr classifier is a box with an inclined bottom 15 ft. long, 2 ft. deep, and 4½ ft. wide at the upper by 4 ft. wide at the lower end. The grade is the same as for the 'mixer-separators'. Lengthwise in each box are two shafts, each carrying



Consolidatated Mercur Mill.

at intervals of 5 in. a toothed scraper-blade, 3 in. deep. These scrapers are actuated by a crank, with 10-in. swing, connected to each shaft. The scrapers are drawn forward along the bottom, then raised and pushed back 10 in., to be drawn forward on the bottom again. The pulp is fed in about one-third of the length above the tailing-discharge, and is subjected to an action similar to that on the 'mixer-separators', that is, the heavier is scraped out at the head and the lighter washed out at the tailing-end. A treatment of the tailing on a second classifier completes the separation of sand from slime. The heads from all the separators and classifiers run direct to a leaching vat, where they are treated as described above. The tailing from the last classifier runs in solution to three circular steel vats 30 by 8 ft. In each vat is a decanter, consisting of a perforated 5-in. horizontal pipe 6 ft. long. This is connected to two vertical pipes, passing through the bottom of the tank. This decanter is set on the opposite side of the tank from the feed-inflow, so that the slime may have an opportunity to settle and leave the decanted solution clean. Part of this decanted solution is re-used by mixing with the ore, and part is run to the precipitating room to be treated with zinc-fume. Agitation of the slime is not attempted, and it is found that the gold goes into solution in 24 hours. The tanks were originally provided with agitators, which are now used to scrape the bottoms when discharged. When a tank has been filled with slime a centrifugal pump transfers the contents to a fourth tank of the same size, where the pulp is thickened and then run to a circular steel sump-tank 15 by 8 ft. A duplex beam air-pump discharges the contents of the sump-tank to three wooden tanks, 10 by 12 ft., from which the pulp runs by gravity to the filter-room. Here are four square steel tanks, 8 by 8 by 7 ft., with a cone-bottom 4 ft. deep, equipped with vertical stationary filters. Agitation is accomplished by pumping from the bottom and discharging at the top, thus allowing all of the solution to reach the filtering surfaces. The filtered solution flows to the precipitating room, and when a tank is full of slime a gate-valve is opened in the bottom, the contents discharged, and the filters washed with a hose. The zinc-slime from the precipitating room is taken to the refinery, where the zinc is dissolved in sulphuric acid. The filtrate is roasted in a furnace with three 30 by 60-in. muffles, fluxed, usually with borax glass only, and charged into the melting furnace. This furnace is double, each side having a capacity of 60 lb. of the product. The roasting is done with coal as fuel, while for melting crude oil is used.

The mill is equipped with a machine shop having the usual complement of tools for a large plant, and a foundry where all but the largest castings are made. The latter has a circular 36-in. furnace, with five 2½-in. tuyeres. Power is furnished by the Telluride Power Co., whose lines enter the camp at a tension of 40,000 volts and are stepped down to 5000 volts at the sub-station and to 220 volts at a transformer station at the mill. The water is pumped from Ophir canyon, seven miles distant, by the Gold Belt Water Company.

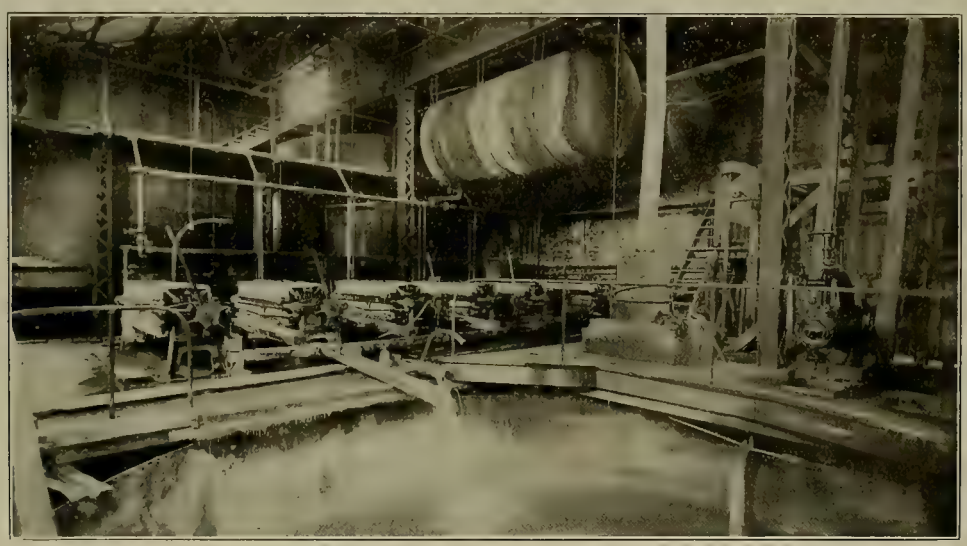
The figures which the management publishes concerning operating expenses during the last fiscal year are doubtless a better criterion as to present cost of production than an estimate that could be made by one not closely in touch with the operations, but it is hardly fair to judge by the year in question, because during that time an unusual amount of development was done, including opening some old stopes directly under the immense mill-dumps. Also, for a large part of the time production was made by only a fraction of the plant. During the period mentioned the average value in the ore was $3.77, all in gold, of which $2.85 was recovered. Mining costs averaged $1.65 per ton, and milling costs $1.27, or a total of $2.92. A loss of 7c. per ton of ore treated was therefore sustained. For the current year it is hoped to bring the costs to the point previously reached, namely $1.41 for mining and $1.07 for milling, a total of $2.48. These figures include all executive and administrative expenses. The slime-plant, as installed, was experimental, and its capacity is not up to that of the mill, which has tended to keep the tailing up to the high figure of 92c. During the time that the mill handled a tonnage in proportion to the slime-plant, the tailing averaged only 46c. per ton. A feature that has caused much perplexity, and which is being experimented upon, is that the slime from the roasted base ore is not amenable to the same treatment as that from the oxidized ore.

About 4½ miles below Mercur, at Manning, is the mill of the Manning Leasing Co., working on the dumps of the old Mercur mill. Here are 700,000 tons of tailing, of an average value of over $2 per ton. The method used is that of the Holderman Process Co. of Salt Lake City. Near the mill a tunnel for tram-cars has been driven into the dump, and bins constructed. Slip-scrapers drag the ore and dump it into a hopper leading to this bin, from which it is trammed to the mill-bins by hand. From these it is fed to two 6-ft. Chilean mills, one Akron, and one Monadnock, and is crushed in solution. Each mill has a capacity of 120 tons. The ore is crushed so that 80% passes a 60-mesh and the remainder a 40-mesh screen. Without separation of sand from slime the pulp is run to the first tier of vats, of which there are 18, each 18 by 6 by 4 ft., with a bottom sloping from back to front with a pitch of 2 in. per foot. The tanks used in the Holderman process have filters on the bottom, sides, and ends, and 34 suspended filters in each 18-ft. tank. These suspended filters are merely canvas sacks over slotted pipes through which the solution can be drawn off. The use of these gives a filtering surface to every 6 in. of length in the tank, and allows the solutions to quickly reach every ore particle. When the process was first tried, agitation was used, but this has proved unnecessary, and has been abandoned.

In the front of each tank, and flush with the bottom, are three discharge-gates with launders running to the second tier of tanks. After treating in the first tank with a solution of 1 lb. excess-alkalinity per ton, the pulp is flushed with clear water to the second tank, the water with the solution left in the pulp, making the proper strength of weak solution,

In the second tier are six tanks, 18 by 6 by 7 ft., with the 34 filters submerged 2 ft. below the surface. The entire time for percolating and leaching is 18 to 24 hours, after which the vats are flushed out. Both strong and weak solutions are collected in a sump, and are pumped to the gold-solution tank at the top of the mill by a centrifugal pump. This tank is 16 ft. diam., with 17 suspended filters to prevent slime getting into the zinc-boxes in case a filter in one of the leaching vats should break. The solution is brought to standard in this tank, and is passed through a zinc-box 18 by 2½ ft. The precipitation is so nearly perfect that the tailing from the zinc-box does not show even a trace of gold. This precipitation takes place in the first three compartments. For the present the precipitate is being shipped, but a refinery is to be built in a few months. The extraction of the soluble values is 97%, with a consumption of 0.35 lb. KCy per ton, and a zinc expense of 1¾c. The Chilean mills are driven respectively by 35 and 50-hp. motors, the latter driving also a centrifugal pump delivering solution from the zinc-boxes to the stock-solution tank. One 5-hp. motor runs a centrifugal pump elevating solution from the sump to the gold-solution tank, and one 5-hp. motor drives a rotary pump for sluicing. Power is taken from the sub-station at Mercur. It is transmitted to Manning at 5000 volts and transformed at the mill to 440 volts. Springs furnish about 115 tons of water (30,000 gal.) per day. Each ton of ore requires 300 to 500 lb. of water.

The plant is designed for 240 tons per diem, and when run at full capacity, treatment costs can be brought down to 60c. per ton. During the winter, owing to the fact that the dump is frozen, and that the mill-bins have not a sufficient storage-capacity to provide against contingencies, only about 140 tons are being treated, at a cost of 70c. per ton. For assistance in obtaining data for the above description, the writer wishes to acknowledge indebtedness to George Dern and Tom Fergusson, managers of the Mercur and Manning companies respectively.



Filter-Presses and Solution Sump, Mercur Mill

VANADIUM DEPOSITS IN PERU.

By D. Foster Hewett.

The two Peruvian vanadium districts are situated in the Department of Junin; Yauli, the less important being in the Province of Tarma, and Quisque (Minasragra) in the Province of Pasco. The Peruvian Central railroad passes through the first, and the second is accessible by horseback from Fundición, on the Cerro de Pasco railroad. A description of the Yauli district will precede that of the more important Quisque district, for the reason that the first throws light on the second. The Quisque deposit was discovered while I was examining the Yauli district.

Though not announced until 1894, the presence of vanadium in the so-called 'anthracite' (asphaltite) of the Yauli region was known in 1892. Theretofore, the asphaltite had been held under denouncement, and exploited with the view to utilizing it as fuel. It is reported that several tons of vanadiferous ashes were sent to France for treatment, but beyond this very little asphaltite was mined. No work has been done since 1899. Several of the less important deposits in the northern portion of the district have been developed to a slight extent, and the asphaltite used locally for fuel.

There is a contact between folded Jura-Trias and Cretaceous sedimentary rocks on the southwest, and more recent eruptive rocks on the northeast, which contain the silver veins of Andaychagua and the copper-silver veins of Yauli. The famous Carahuacra silver mine, and several less important, are in the contact-zone. The Jura-Trias rocks are coarse conglomerates and sandstones, and the Cretaceous is represented by thin-bedded gray and green shales and limestones, the latter predominating. In the vicinity of Toldorumi the intrusion of the eruptive rocks on the northeast has brought up a narrow belt

*Abstract from paper in *Trans.* Am. Inst. M. E., February 1909.

of slates. The veins of asphaltite occur in a well defined belt in the sedimentary rocks, following the stratification, and are approximately parallel, therefore, to the contact mentioned above. Asphaltite veins have been found over a distance of 15 miles. The veins occur as lenses, varying from 0.5 in. to 22 ft. wide, the maximum known length of a lens being about 500 ft. These veins are not confined to one bedding-plane, and may not only break through from one to another, but there may be asphaltite to the extent of 5 ft. in width, filling each of two or three contiguous bedding-planes. Thus there appear to be three veins, separated by single layers of shale from 3 to 10 in. thick. There is evidence of movement subsequent to the intrusion of the asphaltite, which is shown by its pencillate structure of the asphaltite, and by numerous faults of small throw.

The asphaltite is black, lustrous, and softer than ordinary bituminous coal. The hardness does not appear to be affected by the amount of ash present. The material completely lacks evidence of clay-bands and the columnar structure common to most bituminous coals. It breaks clean from the walls, though the country rock adjoining often contains a large amount of carbonaceous matter. No pyrite was observed in the asphaltite at any of the exposures. The mode of occurrence of the asphaltite is essentially the same at the various exposures. The vein has been developed by five tunnels, aggregating about 2000 ft., within a vertical elevation of 300 ft. The tunnels are from 150 to 500 ft. long. Table I, a record of samples from tunnel No. 2, serves to explain in detail the variation in the width of the vein, and the amount of vanadium contained in the asphaltite:

TABLE I.—ASPHALTITE FROM TUNNEL NO. 2.

Sample No.	Length, Ft.	Width, Ft.	Ash, %	Vanadic Oxide, %	Factor.
1	5	5	1.24	1.13	0.0115
2	32	5	13.62	0.91	0.0106
3	66	6	1.35	1.03	0.0105
4	105	5	1.30	1.16	0.0119
5	145	7	6.27	1.40	0.0150
6	182	8	20.14	0.71	0.0090
7	198	6	25.52	0.64	0.0090
8	227	5	13.58	0.82	0.0095
9	246	6	1.31	0.91	0.0093
10	267	7	0.98	0.86	0.0089
11	307	4	46.90	0.67	0.0129
12	366	4	20.93	1.14	0.0145
13	409	4	3.32	1.25	0.0130

TABLE II.—ANALYSES OF VARIOUS SAMPLES OF ASPHALTITE.

Sample No.	Moisture, %	Volatile Matter, %	Free Carbon, %	Sulphur, %	Ash, %	V_2O_5, %	V_2O_5 in Ash, %	Factor.
1	0.98	9.41	84.45	5.52	5.16	0.68	13.1	0.0072
2	...	...	...	...	2.02	1.30	64.3	0.0133
3	...	...	...	...	2.26	1.43	43.9	0.0148
4	...	...	...	...	8.15	0.82	10.0	0.0090
5	1.50	9.84	86.52	7.24	2.14	1.32	61.7	0.0135
6	0.52	8.26	90.58	4.28	0.64	0.49	77.5	0.0050
7	...	...	...	...	1.78	1.34	75.3	0.0136
8	0.66	15.23	63.31	4.07	17.80	trace	...	.....
9	7.83	49.02	31.15	4.54	12.00	0.28	2.3	0.0032
10	...	...	...	...	9.38	0.89	9.5	0.0098
11	0.32	11.16	85.02	6.47	3.50	0.94	27.0	0.0098
12	3.62	48.59	44.28	44.59	3.51	0.54	16.4	0.0056
13	0.08	20.34	78.57	1.87	1.01	0.19	19.27	0.0020

It is apparent that the percentage of ash in the asphaltite from the Yauli district varies considerably. The amount of vanadic oxide in the residue after burning varies between wide limits. This appeared to suggest that the vanadium was independent of the mineral matter in the asphaltite and that, therefore, its origin might be traced to the hydrocarbon portion. The last column in Tables I and II gives a factor derived by dividing the percentage of vanadic oxide in the asphaltite by the percentage of hydrocarbon, considering that all combustible matter was hydrocarbon. It appears that this factor is constant enough to be considered as an index of the solubility of vanadium (probably as sulphide) in the hydrocarbon. About 100 ft. east of the asphalt vein there is an outcrop of a dike of devitrified perlitic obsidian, about 50 ft. wide. It appears to have been intruded along one of the bedding-planes. There are no contact-phenomena other than a noticeable hardening of the shales, though the dike appears to have been the cause of the formation of a zone of pyrite replacing the shale in the foot-wall of the asphaltite vein.

In 1905, a party of Indians, who had been in the mountains searching for coal, brought to Antenor Rizo Patron, metallurgist at the Huaraucaca smelter, on the Cerro de Pasco railway, samples of a material thought to be coal. The material came from a prospect near the crest of the main Cordillera, within the concession of the *hacienda* de Quisque. The prospect had been located for coal no less than three times previously, but was abandoned in each case when it was found that the material contained a large amount of sulphur. Under these old locations the prospect became known as Minasragra. Upon analysis the material was found to contain a high percentage of vanadium.

The area under consideration lies along the western limb of a broad anticlinal in Jura-Trias and Cretaceous rocks. The series in this locality is composed of green shales, thin-bedded limestones, and red shales. The red shales are succeeded to the west by a great thickness of limestones, of which the main range is composed. The vanadium deposit occurs entirely within the red shales. Igneous activity in the form of the intrusion of dikes, laccoliths, and domes, has been a feature throughout a large area in this portion of the Province of Pasco, and these forms have been controlling factors in determining the local topography. It is evident that the vanadium locality has been a unique centre of this activity, there being no less than four systems of dikes, the entire area being probably underlaid by a laccolith. The vanadium deposit is a lens-shaped mass composed principally of three distinct constituents, which occupies one of the faults. The maximum width of this mass is 28 ft., and though the length is partly concealed, it cannot exceed 350 ft. The strike is about N.20°W., and the dip is 75°W. The three materials, in order of relative amount, are: (1) Quisqueite; a black lustrous hydrocarbon; hardness, 2.5; sp. gr., 1.75; fracture, conchoidal. Name derived from the *hacienda* in which the deposit is found. (2) Coke; a dull black, vesicular hydrocarbon; hardness, 4.5; sp. gr.,

2.4; fracture, conchoidal. This coke contains globules of quisqueite. (3) Patronite; a greenish-black mineral; hardness, 2.5; sp. gr., 2.65 to 2.71; fracture, uneven. Name derived from that of Antenor Rizo Patron, who first recognized that the mineral contained vanadium.

The following minerals, found in very small amounts, were recognized under the microscope: Bravoite; a reddish-yellow mineral in patronite. Composition (Fe, Ni) S_2; hardness and specific gravity not known. Also an undetermined silicate mineral resembling halloysite.

Analyses of these minerals made by Hillebrand show:

TABLE III.—ANALYSES OF VANADIUM MINERALS.

	Patronite, %	Quisqueite, %	Coke, %
Sulphur, sol. in. CS_2	4.5	15.44	0.64
Sulphur, combined	54.29	31.17	5.36
Carbon	3.47	42.81	86.63
Hydrogen	....	0.91	0.25
Nitrogen	....	0.47	0.51
Oxygen, by difference	....	5.39	4.64
Water, at 105°	1.90	3.01	None
Ash	....	0.80	1.97
Vanadium	19.53		
Iron	2.92		
Nickel	1.87		
Silica	6.88		
Titanic oxide	1.53		
Alumina (phosphoric acid)	2.00		

Also small amounts of ferric oxide, manganese, chromic oxide, and alumina.

The silicious matter, and possibly the carbon, may be considered impurities, and patronite approaches in composition a compound of vanadium and sulphur, which can best be represented by the formula $V_2S_5 + nS$. The nature of patronite and its relation chemically and genetically to quisqueite in coke is made clear by a close study of microphotographs. These show patronite, quisqueite, coke, bravoite, and silicious mineral, in varying proportions. Quisqueite is a black material, generally in the form of globules, though sometimes only a thin film lines the cavities. The coke is black, but duller in luster than quisqueite, and is found in the sections as an irregular network resembling a sponge. Patronite fills all the portion not occupied by coke and quisqueite, and is the light material showing the greatest relief. Bravoite is of irregular occurrence. The white segregations are the silicious minerals referred to above. It is clear that the materials are segregations from a mass which was probably originally homogeneous. Quisqueite was the first material to segregate. The larger portion was crowded to the walls. It probably segregated through insolubility in the remaining mass, rather than on account of difference in melting-points, for it appears to have been viscous after the segregation of the coke. Moreover, it was probably unstable at the temperature then existing, this being suggested by the globules, which are more or less coked. The coke segregated after the quisqueite, and though nearly pure, it must have had the consistence of a paste, for it was able to form solid, fairly homogeneous masses.

Before the solidification of the patronite took place, there must have been a disturbance, due probably to the upward movement of the mass. This is shown by a crushed condition of the coke, and to a less degree of the quisqueite. Patronite was the last mineral to solidify, and from its associations appears to have been the eutectic of the mass. It fills all of the cracks and spaces between the globules of quisqueite and the walls of the cavities. The fact that patronite is of the nature of a eutectic serves to explain why its composition does not accord with the usual valency of vanadium, as eutectics, though generally constant in composition, are seldom compounds to which a formula may be assigned.

Patronite appears to have had the peculiar property of being able to permeate the porous country-rock, even to the degree of saturation. At some period, after the mass had become solid, a convulsive movement re-opened the fault-line, rending the mass from end to end, as shown by a clay-filled fissure. The red shales are not only crushed, due to faulting prior to the appearance of the mass, but are much bleached, probably from the action of sulphurous vapors.

Two minerals of approximately definite composition have been found upon the surface. Both are hydrated oxides of vanadium, and though partial analyses only have been made, they appear to be new species. Hillebrand is inclined to regard them as salts, not as oxides or acids. The first, which will be called the 'red oxide', has been analyzed by Hillebrand. It occurs as globular aggregates with radiated structure, though amorphous material is common. The color is deep brownish red to red; streak, red; sp. gr., 2.30 to 2.48; hardness, 2.5. The second, which will be called the 'brown oxide', shows loss on ignition, 19.0, and vanadic oxide, 72.50%. The brown oxide is found along the outcrop in irregular amorphous masses, none having a tendency toward more definite structure. It is dark brown in color; streak, dark brown, sectile; hardness, 2.0; sp. gr., 2.30. It has the peculiar property of swelling and disintegrating when placed in water.

TABLE IV.—ANALYSES OF RED AND GREEN OXIDE.

	Red Oxide. %	Green Oxide. %
Vanadic oxide, V_2O_5	67.60	57.33
Vanadium tetroxide, V_2O_4	trace	4.76
Molybdic oxide	2.82	3.28
Silica	1.17	0.57
Titanic oxide		0.07
Alumina	3.31	....
Phosphoric oxide (?)		....
Ferric oxide		19.53
Lime	4.30	0.70
Magnesia	?	trace
Water	20.81	13.89

At a depth of 8 ft. from the surface, the red and brown minerals are replaced by one having a greenish-black color. It is generally amorphous, though along openings or water-courses it appears velvety, which appearance, under the microscope, is resolved into aggregates of acicular crystals, resembling a form of malachite. The sp. gr. of the mineral is 2.52.

Solution of vanadium compounds is in process continually, and waters flowing from the tunnel show a

considerable amount of vanadium in solution. Waters percolating through the walls of the tunnel deposit an orange incrustation which Hillebrand says is apparently a hydrous calcium salt of hexavanadic acid, that is, $Ca_2V_6O_{17} + xH_2O$. The x is between 10 and 11. Water is about 22%. The calcium oxide is about 12.8%, and that of V_2O_5 about 65.4.

The occurrence of vanadium in hydrocarbons is not confined to Peru. It has been announced by Kyle in the ash from a coal (asphaltite?) found in the Province of Mendoza, Argentine Republic; also from other localities mentioned in Clarke's 'Data of Geochemistry'. I have found it in the ash from an asphaltite from Page, Oklahoma. The material contained 1.10% ash, of which 0.19% was vanadic oxide. A review of the original articles describing the above-mentioned occurrences has convinced me that all of these materials are closely related. They all appear to be asphaltites containing an appreciable amount of sulphur.

Asphaltites are probably derived from petroleum. All asphalts contain sulphur, and the hardness of the mineral appears to depend upon the amount present. The occurrence of vanadium in asphaltites appears to depend upon three factors: (1) Vanadium, as oxide, disseminated through a rock of a fair degree of porosity. (2) Impregnation with a hydrocarbon. (3) A source of sulphur or sulphuretted vapors. The first of these conditions undoubtedly often exists over large areas, in the two districts in Peru under consideration; the two remaining conditions have undoubtedly been brought about by the intrusion of the dikes. It would seem, therefore, a safe forecast, that most asphaltites containing more than 2% sulphur also contain vanadium. The Quisque deposit may be interpreted as an extreme phase of differentiation from asphaltite, the intrusion of the dikes probably having had the effect of successively concentrating the vanadium. The unique climatic conditions account fully for the formation of the large aureole of oxidized ores. Had there been erosion by water, even to a slight degree, the oxidized minerals would have been carried away, instead of being permitted to accumulate in the porous country-rock.

From June 1906 to January 1909 there has been produced and shipped to the United States 1800 tons of the oxidized ores, containing about 20% vanadic oxide, and the product from roasting 400 tons of the sulphide ore, namely, the patronite.

Modifications of the Mond gas producers worked out by Frank and Caro in Germany adapt them to the use of peat for fuel. By this process the greater part of the combined nitrogen of peat may be recovered as ammonium sulphate. American peats show more than 3% nitrogen. Peat with but little more than 1% yields enough ammonium sulphate to pay for running the plant, for maintenance, for gasifying the peat, and for a profit besides. A large part of the gas remains as additional profit. Peat beds of proper character may therefore soon become profitable sources of power and ammonium compounds in the United States. By the Frank and Caro process, peat with from 40 to 50% of water can be used.

SYMMETRIC STRUCTURE IN LIMESTONE AND LAVAS.

By R. H. Chapman.

*In 1902, while crossing the Rocky Mountains in the Lewis and Clark Timber Reserve in Montana, I found several specimens of limestone of peculiar structure. One of these was in a position to be photographed, and Fig. 1 shows the specimen. The block is about 45 in. long, 30 wide, and approximately 24 thick. These forms I have called 'firkin' limestone, as they suggest butter-tubs of various sizes. The cylinders, which lie with their major axes perpendicular to the bed-planes, range between 6 and 18 in. diam., and are formed of concentric shells of hard blue-gray limestone, often separated by narrow bands of brownish-yellow gritty material. These rings weather and break from the blocks in circular segments of various thickness. Where they occur in large masses which have been long exposed to the weather, the surface of the blocks seems to be modified by erosion, and to assume a form shown in Fig. 2, which is from a photograph by Bailey Willis, who describes the rock as showing large concretionary or 'coralline' masses.

In this mass many of the forms appear to be of irregular outline, and while the circular form is predominant, it is not so to a great extent. In this specimen the irregular forms seem to be due to weathering, fracturing along curved planes which are often tangent to the structural cylinders (Fig. 1, near head of hammer). Fig. 1 and 2 are from the same region, but separated by many miles. These firkin forms occur in the upper part of the Siyeh limestone, about 500 ft. from the top. This limestone is one of the beds in the Algonkian series described by Willis,[1] who also says: "Mr. Walcott states that these forms are similar to those found in the pre-Cambrian rocks north of Helena, Montana, but as yet they have yielded no evidence of organic origin." Walcott also states that he finds similar forms in the pre-Cambrian rocks in the Grand Canyon of Arizona. In several localities in northern Montana a modified form of structure was observed, the 'firkins' having an elliptical cross-section instead of a circular one. This modification is probably accomplished by pressure, which may have been supplied by the intrusives described by Willis as occuring in this series of rocks. "Siyeh limestone[2] is often characterized by peculiar internal structures, and by large concentric growths; indistinctly fossiliferous, associated with an intrusive diorite sheet and dikes, with an extrusive diabase flow at its upper surface * * *"[3]

Stutfield and Collie mention finding:[4] "* * * petrified stems of pine trees that have been broken

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[1]*Bull.* Geol. Soc. America, Vol. XIII., p. 316, 'Stratigraphy and Structure, Lewis and Livingston Ranges, Montana,' Baily Willis.

[2]*Bull.* Geol. Soc. America, Vol. XIII., p. 318.

[3]*Bull.*, Geol. Soc. America, Vol. XIII., p. 316.

[4]"Climbs and Explorations in the Canadian Rockies, p. 139, illustration opposite p. 142.

off about a foot from the ground." and so forth. These forms are described as existing below 9000 ft. in the ascent of Mt. Murchison, which is about 50 miles north of the C. P. R. at Field, in latitude 52°N., and 116 30'W. This is undoubtedly the same 'firkin' limestone.

From this, and from Mr. Walcott's statement, it seems that this peculiar structure is widely dis-

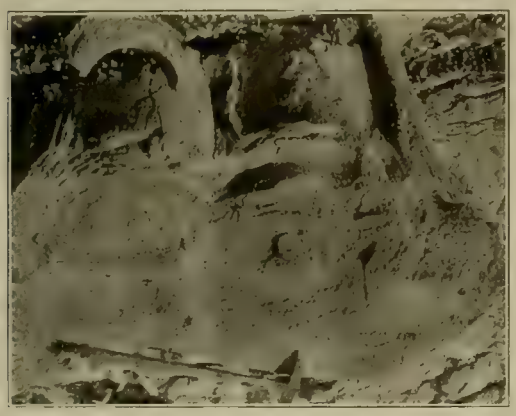


Fig. 1. Firkin Formation in Limestone.

tributed in a horizon above the middle Algonkian.

Since the above was prepared for publication, Mr. Walcott has determined the cylinders described to be fossil forms and has named them 'Cryptozoan



Fig. 2. Concretionary or Coralline Structure in Limestone.

Prolifica'.[5] Similar forms have been found in the pre-Cambrian rocks west of Saratoga Springs, New York, and described by Hall.[6]

[5] *Proc.* Geol. Soc. America, 1906.

[6] *Report* No. 36, N. Y. State, Museum Nat. History, 1884, 1895.

Limestone found in Franklin county, Missouri, by Burchard, shows circular rings similar in appearance to those in Fig. 1, and Burchard states that the



Fig. 3. Conchoidal Structure in Lava.

whole form is cylindrical, very like the 'firkins' of the Montana specimen.

Interesting in comparison with the limestone forms are Fig. 3 and 4, which are representations of entirely different rocks. Fig. 3 is described by Gilbert as: "Conchoidal structure in lava near Cascade, Oregon." It strongly suggests the limestone form in the fracture-planes due to weathering, which to a large extent parallel the joint-planes in the rock. Fig. 4 is by Irving, and is described as: "Spheroidal



Fig. 4. Spheroidal Weathering of Porphyry.

weathering of mica-diorite porphyry," found near Terry in the Black Hills. In this illustration the similarity of the weathered surfaces to those of the limestone from Montana is striking, and that the elliptical ring-like structure of the rock-mass is definitely related to the joint planes is evident.

SCREEN ANALYSIS AND GRINDING EFFICIENCY.

By Arthur Yates.

*The tests recorded in this paper were made at the mill at Redjang Lebong, Sumatra. The practice consists in taking samples of an average of about 30 oz. dry weight, representing the day's run. This is taken from the pulp going to the tube-mill amalgamation-house. It is graded or sized wet for 20 min. on each screen, using No. 60, 100, 150, and 200-mesh screens. The samples are then dried and re-sieved. The results of dry-screening only are used in the calculations.

The results show that when operating under regular conditions the percentage-extraction on any particular sized product is a fixed figure quite independent of the assay value of the charge. From this it follows that, given the percentages of the various grades, one can calculate the percentage-extraction for the whole sample, or, given the total percentage-extraction or efficiency-number one can, with the help of a factor, obtain a figure which should correspond closely to the efficiency-number for the sample or the percentage extraction.

$$\frac{\text{Percentage extraction}}{\text{factor}} = \text{efficiency-number.}$$

Efficiency $\times$ factor = percentage-extraction.

The factor should be obtained from a long series of sizing-results and assays, otherwise a material error may be introduced. These factors assist in finding where errors occur, and any serious discrepancy should be at once investigated. At Redjang Lebong work at present is in a transitory stage, the stamping and tube-milling conditions continually changing as plant is increased, so I have not been able to use the factors over any longer period. I find that a fairly regular factor for the sand-plant extractions can be obtained direct from the daily tube-mill sizing-efficiency number.

For correct efficiency-numbers it is necessary to use a large number of screens, otherwise considerable errors may be introduced, but for general plant-work a few standard sizes answer very well, in comparing the work done and the distribution of assay values. Unless the percentage of coarse grades is high, no great error enters into the calculation, but in the case of fine screens small differences of the sizes produce large differences in the percentage efficiency; thus the separation of the —200 product into sand — 200, ($\frac{0.003 \text{ in.} + 0.002 \text{ in.}}{2} = 0.0025$ in. mean) and elutriated slime ($\frac{0.002 \text{ in.} + 0.001 \text{ in.}}{2} = 0.0015$ in. mean) in place of calculating on a basis of — 200 only ($\frac{0.003 \text{ in.} + 0.001 \text{ in.}}{2} = 0.002$ in. mean) completely alters results. For instance, the June sand sizing given above works out 349.0 by one method, and by the other 361.2, while the slime sizings give 596.3 and 484.4, respectively. The stamp-mill at Redjang Lebong consists of seventy 1050-lb. stamps. The stamp-duty is as follows:

Screen.	Tons.	Horse-power.	Daily Stamp Tonnage.
16-mesh	280	183	4.0
20-mesh	259	183	3.7
35-mesh	210	183	3.0

There are six Schmidt-Davidsen tube-mills, 16 ft. 6 in. by 4 ft. 6 in., outside measure; only four of these are used. The mills are lined with a local eruptive rock, and are fed with vein pebbles. Each mill consumes on the average 47.5 hp., and on starting requires considerably more. As the result of a large number of screen-analyses I obtain the following results:

Battery Screen-Samples.

Screen.	+100.	+150.	+200.	—200.	Efficiency No.
16 mesh	45.7	8.2	5.2	41.1	259
20 mesh	43.2	7.9	6.2	42.7	271
35 mesh	24.8	9.3	9.2	52.7	326

After Tube-Mills.

Stamps	Mesh	Tube-mills	+100.	+150.	+200.	—200.	Efficiency No.
70	16	3	4.8	23.8	8.5	62.9	393
70	16	4	1.1	7.2	17.7	74.0	438
70	20	3	3.4	13.8	14.4	68.3	415
70	20	4	1.3	7.1	14.0	77.5	444

In placing the tube-mill efficiency-numbers side by side with published results from other mines, it was suggested by S. J. Truscott that the introduction of the power-figure and the tonnage would make the comparison fairer, as power and output apparently varied so much in different districts. This gave a figure which we called the relative efficiency:

$$\text{Relative efficiency} = \frac{\text{Sizing efficiency number} \times \text{tons}}{\text{horse-power}}$$

It will be seen that it affords a fair means of comparing all types of crushing and grinding appliances, and should, apparently, prove useful in assisting in the selection of the most efficient and economical machine. The following table gives a comparison of the above crushing figures:

Stamps, Number.	Screens, Mesh No.	Tons per Stamp per Day.	Tube-mills, Number.	Tube-mill Daily Tonnage.	Horse-power.	Grinding Efficiency.	Relative Efficiency	Relative Efficiency to Unity.
70	35	3.0	..	210	183	326	373	1.00
70	20	3.7	..	259	183	271	383	1.02
70	16	4.0	..	280	183	259	396	1.06
70	20	3.7	3	259	325	415	330	0.88
70	20	3.7	4	259	373	444	308	0.82
70	16	4.0	3	280	325	393	341	0.91
70	16	4.0	4	280	373	438	328	0.87

The table discloses that stamping with 35-mesh screen compares favorably with the coarser screens, and that when running tube-mills in conjunction with the stamps the relative efficiency is not so high as with stamps alone, but there is a tendency for a higher efficiency with the latter when coarser screening is used. I have not been able to find any complete sizing results of work done in grinding-pans, Chilean mills, Huntington mills, and the like, so I cannot compare the relative efficiencies of these machines with stamps and tube-mills, but a comparison with those machines would be most interesting.

*Abstract from paper read before the Chemical, Metallurgical & Mining Society of South Africa, December 19, 1908.

GEOLOGIC ESSENTIALS OF A MINE REPORT.

By Courtenay De Kalb.

*Whether an engineer's advice be frankly optimistic, or frigidly conservative, should depend in no small degree upon the character of the client and the purpose he had in ordering the examination, but the kind of enquiry he should make to secure data for a mine report does not depend upon the use to be made of it. This may startle those who have given their adherence to current scientific orthodoxy, for I am aware that the confession of faith by the engineering hierarchy affirms that an examination should yield fact and nothing but fact, and that every opinion should be so well grounded as to partake of the nature of eternal truth.

An opinion is not fact, and no amount of argument can wash out the last color of uncertainty that leaves it still something less sure than demonstrated verity. If any man among you has ever read a mine-report that did not try to persuade one to accept opinions, I would suggest that the next step in order would be to test the intellectual reliability of the man who wrote it. Lest you be inspired with the belief that a mine-report is a thing lacking in definiteness because of inherent difficulties in obtaining data, it may be well to affirm that undemonstrability in varying degree is a feature of nearly every enterprise upon which men pitch their faith and risk their money. Human affairs are not regulated by mathematic rule. No civil engineer's estimate ever advised a capitalist how much the construction of a railroad would actually cost; a man of experience may have hit it by a prudent assumption, which he might term an estimate multiplied by a factor of safety—but the factor of safety expressed his opinion. It may have been a better one than yours or mine, but still it was an opinion. It was because he had had experience enough to know how to guess wisely that he, and not you or I, was able to make so close an estimate. The world works out its plans by a good combination of fact and guess, and the value of the guess depends on the experience and common sense of the man who makes it. But the profound guesser is ever a man of deep humility of spirit. He is not puffed up because of his skill; indeed, he is largely unconscious of the process by which he exercises his gifts of seeing deeply. He is more reverent in the face of fact, and more zealous in seeking it, than the man who thinks lightly of responsibility. He who is conscious of the intuitive faculty is a perilous leader.

How shall we make this square with the affirmation that the character of a mine-report should depend upon the use your client proposes to make of it? If the desire be to employ the information as a warrant and guide for development, the engineer's point of view would, or should, differ widely from his attitude toward the problem if the purpose were to buy or sell the property. His responsibility is altered by the intent of his client; if a man be inclined to put money into mining carefully and prudently, as he would purchase lands for development or establish a factory, he would require entirely different advice than if he were disposed to take chances in the hope of winning largely. In short, from the point where a man may proceed chiefly upon opinion based on scant indications of outcrop, every grade exists up to the point where he deals in measured quantities ample for justifying all his recommendations; and every grade exists also between the judgment he will deliver for a client who needs to be held back from reckless risk, to that required by the timid sort for whom any expression of opinion would be a clear injustice because of his abhorrence of chance.

The engineer who would give the same kind of advice relative to a given property under all sorts of circumstances is one whose competency would be open to doubt. A man must be human to deal adequately even with problems of geology and the economics of mining.

Having established the heterodoxy that a mining engineer must really use the judgment that comes from experience, and not decide by rote and rule of thumb, the next point to fix in mind is that he should distinguish between fact and opinion as he would between light and darkness. Moreover, he must distinguish between competent and incompetent fact in a spirit of the highest professional self-abnegation. There is a tendency in human nature to magnify attainments, to exalt the knowledge of the art by putting more of it in evidence than is necessary. Greatness consists to a considerable extent in stripping off the encumbrances which arise through complicating our performance with unnecessary things. The unnecessary is always dangerous; it lays one open to error, confuses the mind, and obscures the truth. Only those facts which bear conclusively upon the point at issue are competent as bases from which to draw conclusions.

When an engineer arrives upon a property it is his duty to observe everything which the limits of his engagement permit. Here again the engineer cannot declare what he will or will not do in regard to time. He does the thing that has the largest immediate economic value for his client, from a fleeting reconnaissance to a complete and minute examination. There is a curious tendency among engineers to flourish a vast deal of indeterminate geology in mine-reports. It is the easiest side of the work from which to gather wool to pull over the eyes of the laity. I say this without any malicious imputation. It is a fact of observation from the reading of multitudes of mine-reports. Even men who are amply trained and ripe in experience are drawn into this peculiar groove. In its exaggerated form it is pure charlatanry; in its milder manifestations it is a frill of the craftsman that adds nothing to his dignity, and weakens his power to sift evidence.

So far I have dealt with the question on the side of integrity, apart from concrete instances. A man sent to examine a mine is usually hurried. Opportunity to exhaustively study a deposit is rare. Such work as was done at Ely, Nevada, at the Utah Copper mine in Bingham canyon, at Miami and Ray, in Arizona, are exceptional. The elaborateness of the study naturally depends upon the financial responsibility

*An address delivered before the Geologic Society of Stanford University, April 13.

involved. In any case the purpose of the examination, and the end reached, are the same, namely, the ascertainment of facts of economic importance. The first consideration is the presence or absence of the substance sought in quantity sufficient to warrant further examination. The prime matter then is the metal in the deposit. Geological indications must not count in the initial stages of an investigation. The nucleus is the ore. Find that first, and work outward into the successive layers of the problem. Before strictly geological work should begin the engineer should acquaint himself with the character of the ore, and its distribution in the lode. He should know its mineralogic habit, its gangue, and the associated phenomena when the lode grows richer or leaner. Hence the first work to be done is chemical and mineralogical, and the examining engineer should go equipped for qualitative analysis and mineral determination. Excellent kits are now provided for travelers in compact form, sufficient for a wide range of accurate work.

In the process of studying the vein some information as to its derivation may be obtained. But the matter of vein-genesis is one of the most difficult with which the economic geologist has to deal in the practice of his profession. This was in my mind more than any other consideration when I spoke of the tendency to overload a report with indeterminate geologic statement. It is the fashion today to state how the vein was formed. He is a courageous man indeed who will write a report without attempting to pronounce on this question, and usually it is the one thing above all others that had better be dealt with warily. You may be decidedly of the opinion that the vein is an impregnation, or a metasomatic replacement, but only an exhaustive study can give large significance to those facts. Indeed, without microscopic evidence one may err as to either deduction, and further revelations as to the details of the process are needed before the conclusion can possess much economic worth. It must be remembered that the public is eternally demanding that the mining engineer become a prophet, and he in turn is trying with all his might not to disappoint the hopes held of him. He often yields so far as to stretch his geology beyond the sanction of his conscience. It is dangerous business, that of prophecy. But an engineer has no right to hedge; he should state his conviction, uninfluenced by the use or misuse likely to be made of it. After elaborate examination of the local geology wonderful predictions have been made; the classic case is that of S. F. Emmons at Leadville. But the engineer must not be led by the example of work done with such detail to promise continuity of deposit from superficial evidence. Ore deposition is usually a matter of chemical reaction, and the thing to demonstrate is that at points beyond the scope of present observation in mine-workings, the necessary chemical agents and reagents were probably present. There is the first great limitation. The man who has the judicial type of mind will wait long and labor patiently before he will announce the continuance of the same chemical conditions, as shown by mere end-reactions, to any considerable distance beyond the point of his pick. He may guess, and his experience will add large money-value to his surmise, but the true geologist will wait for proof before he announces the manner of genesis of a vein, or deduces extension in depth from the fact when he has gained it.

The second great point to determine is the localization of ore into shoots. The habit of nearly all deposits is to occur in zones of enrichment. It is important to know whether these are due to segregation, to deposition in channels or spaces of greater porosity, or to other causes. But here again the microscope and exact chemical analysis are usually necessary. Unless the cause of the localization can be demonstrated it were better to hazard no conjecture, resting content with the determination of the size and position of the shoot. The existence of secondary enrichment should be ascertained if feasible. In the case of copper this can to some extent be done, although the occurrence of primary chalcocite having been conclusively proved, the problem is not always easy. The existence of chalcocite and bornite in great abundance will, however, always raise a fair presumption in favor of an enriched deposit. The engineer here confronts another limitation. Exhaustive work is usually needed to demonstrate the fact of secondary enrichment, and as the term has come rightly or wrongly to convey to the layman an impression of substantial size and value, the conscientious engineer should ordinarily be content to define and sample the ore-shoots, and leave the questions of whence and how the metalliferous solutions came as a matter to be determined by later incontrovertible evidence.

As most ore deposits exist in the form of veins it becomes pertinent to determine how the zone which has become mineralized had been prepared for either the alteration or the filling that has taken place. The most frequent agents are faulting, shearing, and alteration by contact metamorphism. Magmatic segregation, while usually insufficient to cause enrichments of economic value, is potent in furnishing deposits which through further concentration by solutions become valuable. The solvent power of water in the rocks, aided by carbonic acid and other gases, is great enough to take up metallic compounds, and convection and diffusion will transfer the salts and ions respectively to points where reactions resulting in deposition can occur. Once begun, this process will continue so long as conditions remain unchanged, and the accumulation of metal will increase until masses of great size may result. Diffusion can go on without the previous existence of any crushed area or zone of special porosity, and it may be accomplished without any movement of the solution itself. The juxtaposition of two masses of rock presenting important differences in chemical composition promotes the formation of orebodies along the contact by virtue of the increased opportunity for chemical interchange. This again may be independent of what are known as contact phenomena. In fact such phenomena, which are due to wide differences in temperature between the two rocks when brought into their existing relations, are not necessarily conducive

to the formation of ores. They are quite likely to result in reducing the porosity. The movements of rock magmas at great depths are extremely slow; violent intrusion is mostly superficial and results in the formation of dikes, sills, and occasionally batholiths. Hence the invasion of a group of deep-seated rocks by magmas frequently occurs under such conditions that the temperatures of the two are not far apart, and no important changes in character result along their borders.

The determination of the manner in which the ore-bearing zone was made ready for alteration is then one of the prime geologic facts which the engineer should seek to ascertain. Discrimination between fault-planes and shear-zones leads to useful deductions. While fault-planes may reach to profound depths they are also liable to be erratic. Shear-zones are more reliable, and may be more safely taken as indicators of the existence of deeply continuous shoots of enrichment.

The orebodies along a contact are prone to be connected by stringers, and may reach to great depths; segregations incline to the formation of isolated bunches, but where one is found many may be discovered by exploration. While these circumstances may not encourage boldness in prophecy, they are significant as indicators, from which the man of experience can draw valuable conclusions. Moreover, these conditions are usually capable of being ascertained with reasonable definiteness, even during a hasty reconnaissance.

From the foregoing it is evident that even a cursory examination requires attention to the surrounding rocks. The country rock is the correlative of the orebody. It is often related most intimately to the genesis of the ore, and some hint of that function may appear in the data the engineer's field work may supply. The exact kind of rock, however, is of less importance than the chemical characteristics. Rock-names are often the cloak of superficiality. It means very little to say that the hanging wall is granite, and the foot-wall gabbro; but it means a great deal to say that the hanging wall is a granitoid rock, highly silicious, with orthoclase feldspar, scant biotite, and abundant accessory hornblende, while the foot-wall is an apparent gabbro, with abundant labradorite, much pyroxene, primary pyrite, and so forth. These are facts which the field-worker can determine positively in a few minutes, and they convey genuine information. It is of value to state the relationship of stratified rocks to the deposit, in which case the kind of sedimentaries and their condition should be noted. But if you do not recognize a rock, do not attempt to name it. State what you see, describe the mineralogical peculiarities determinable by such means as you have at command, and let it go at that. The great majority of crystalline rocks do not admit of close classification until they have been studied in detail with the aid of the microscope.

Almost invariably a vein or metalliferous mass represents a zone of weakness. In consequence subsequent earth-movements affect these less-resistant areas with special facility. Fault-zones constitute expansion-joints in the lithosphere, and veins are largely associated with these lines through which the earth-tension is relieved. The evidence of movements subsequent to the filling of the veins is usually recorded so that the trained observer will find no difficulty in recognizing them. This is one of the facts worth while to ascertain. It means that there has been afforded opportunity for re-arrangement of the primary ore by later alteration, solution, and re-deposition. It often involves rejuvenation of the circulation of heated waters from below. I have in mind a particular case at the Exposed Treasure mine near Mojave, California, where an original brecciated zone was produced by shearing. This was followed by silicification, resulting in a dense cherty filling carrying large quantities of finely disseminated pyrite, with some chalcopyrite, but the precious metals were almost totally absent. Later the region was disturbed by movements induced by the intrusion of basic igneous rocks underlying the older acidic magma which had formerly caused extensive outflows of rhyolite. The basic rocks were erupted many miles away, and did not invade the country immediately surrounding the lode, but the equilibrium was disturbed, and in its re-establishment faulting occurred which brecciated the primary vein. Through this channel arose solutions rich in lime, iron, and copper, carrying gold and silver. The significance of these facts in determining a warrant for development in depth is apparent.

It must be observed, however, that faulting is not the only means by which movements may be produced in veins. Most lodes are of the replacement type; if not strictly so, at least alteration is commonly attendant on the genesis of the deposit. Rarely such changes take place without change of volume. Usually there has been either shrinkage or expansion. Shrinkage leads to complex fissuring within the lode, which may be healed by subsidiary venation. It often possesses great economic importance. It is always a point worthy of note. Expansion of volume leads to 'slips,' that is, joints or parting-planes produced by relief of the pressure from squeezing. These are commonly conchoidal, although not necessarily so. Such expansion is likely to record itself by dislocations of the wall-rocks, and sometimes by coarse brecciation of the lode itself, but of a type entirely different from that commonly yielded by brecciation due to faulting; the brecciated mass in this case is re-consolidated by the pressure without interstitial filling by foreign material. Brecciation of a lode by faulting leads to profound effects; 'slips' from expansion may affect a lode to limited depths only, because the character of the material may not remain constant far below the point of observation.

Another circumstance of vital moment, when it can be ascertained, is the probable amount of erosion since the vein was formed. This may reveal, aside from internal evidence given by the vein, whether the visible ore is probably primary or secondary. In the absence of deep workings the determination of this fact is often of high economic value. Enrichment of the upper part of a vein is to a certain ex-

tent evidence against the continuity of like metallic content to a considerable depth. In the case of gold ores, unassociated with much copper and iron, it would lead to grave suspicion of superficiality. With copper the same conclusion would not be warranted; nevertheless I have observed many cases where it applied with force even to that metal. In an arid or semi-arid country the existence of an abundance of sulphides near the surface is in itself a strong evidence in favor of the ore being primary. The conclusion, however, is not always justified. I have been surprised to find remarkable superficial secondary enrichments of copper sulphides in two widely separated regions under the most diverse climatic conditions. One of these regions is along the north shore of Lake Huron, where veins through sheared diorites are frequently rich in chalcopyrite close to the outcrop, but prove lean, and sometimes barren, in depth. These rocks have been glaciated, and the enrichment has apparently been accomplished by leaching upward as a result of capillary flow induced by evaporation at the surface. It is quite improbable that percolation downward occurs through the capillary openings of these dense homogeneous rocks. The other region is along the semi-arid western slope of the Sierra Madre in the State of Sinaloa, Mexico, where the destructive effects of meteoric agencies are extreme, and the annual erosion of the disintegrated rock-surfaces during the violent rainy season is excessive. In spite of these conditions copper veins in the andesitic rocks are often characterized by superficial enrichments of chalcocite. In both cases the enrichments noted were conformable to the topography, which circumstance alone would be a guide to the interpretation of the phenomenon.

I may call attention, by way of example in determining whether an ore be primary or secondary, to an interesting case in the Bazonopa district in southwestern Chihuahua, Mexico. The Guadalupe vein at La Cumbre de San Manuel is one of a series of remarkable silicious lodes, carrying sulphides of iron and copper, with varying amounts of gold and silver. The sulphides are found at the very outcrop, affording the first hint that the ore was primary. The lode lies between an acid crystalline rock of dioritic character, and a basic andesite. The andesite has been intruded by dikes of trap, approximately parallel with the lode. Erosion has carved a deep canyon, with sides sloping at about 38°, in the relatively soft andesite. The vein outcrop extends along the base of steep scarps of the diorite near the top of the ridge. The vein being silicious stands above the andesite, but by reason of a gouge between it and the diorite it shows a tendency to detach in blocks as denudation of the andesite undermined its support. In the bottom of the canyon, blocks of the ore were found in great quantities. Some concentration of gold had occurred adjacent to the gouge, that had yielded rich pockets to the early Mexican miners. The mass of the ore, however, was not secondarily enriched. The evidence was conclusive. Erosion was proceeding faster than decomposition, and the ore was clearly primary.

The points which are essential in the geologic examination of an ore deposit may be summarized as follows: (1) Presence of ore. (2) Character of the ore. (3) Distribution of the ore in the deposit. (4) Ore-shoots. (5) Mineral associates of the ore. (6) Secondary enrichments. (7) Cause of the ore-bearing zone. (a) Mechanical. (b) Chemical. (8) Country rocks. (9) Contact phenomena. (10) Subsequent movements in the vein. (a) Faulting. (b) Shrinkage. (c) Expansion. (11) Order of deposition of minerals in the vein. (12) Erosion in its relation to primary or secondary ore.

There may be many other salient conditions which would be observed, but the foregoing are those regarding which as much evidence should be obtained as possible. Concerning these there should be no guessing. As far as the situation warrants, the statements should be those of simple and demonstrable fact. A well trained field geologist will obtain a great amount of information from only a few days' work in the field, but the correlation of these items for deduction of probabilities concerning the ore deposit is usually so speculative as to involve danger of falling into error. The report itself should contain nothing but proved facts and the logical inferences from them. Additional data should be submitted in the form of an appendix, never in the report itself. To do otherwise is to confuse reality with surmise, and to reduce the value of the report from an economic standpoint.

I affirmed in the beginning that the advice given should depend upon the use to which it is to be put. It is now plain how the engineer may gauge his discretion. The report itself must be a document based on ascertained fact. It must present the things on which opinions cannot differ. A supplementary statement, however, can convey the results of observation which are open to conflicting interpretation. Here the experience of the engineer counts heavily. Here he may pass beyond the realm of demonstration to that of opinion. In this he may render advice in accordance with his expectations based on analogy, tempered by considerations of the use or misuse which may be made of the convictions to which he has been led. The opening of mines consists in plunging into the unknown in search of treasure. It is as much a part of the engineer's duty to forecast probabilities as to determine facts, but the two must not be entangled. The known and provable must be separated by a sharp plane of cleavage from the problematical.

The electrolytic method, now used so largely for refining copper, silver, and gold, has been but little used for tin, because this metal is easily refined by other methods. An electrolytic process, however, is in use at an establishment near Liverpool. Anodes of tin with 10% impurities are placed in a 10% solution of Na_2SO_4 with cathodes of block tin, and traversed by a current of 0.06 amp. per sq. in. at a voltage of about 0.2, the temperature being kept at about 194° C. About 1% by weight of sulphur should be added to the bath before each renewal of the anodes, to combine with the impurities in the anode and act as a depolarizer, so that electrolysis can be commenced at a low voltage.—*Scientific American.*

ADJUSTABLE PYROMETER STAND.

Written for the MINING AND SCIENTIFIC PRESS
By L. W. BAHNEY.

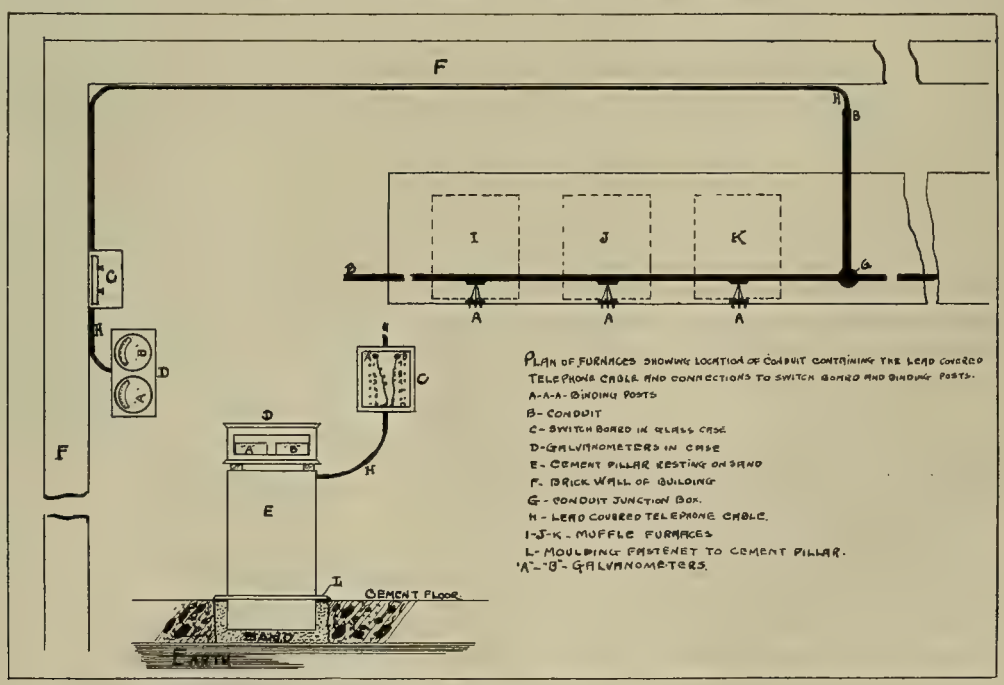
The stand shown in the illustration was made especially for the purpose of holding a tube, either of clay or of fused quartz, in which are enclosed the platinum and platinum-rhodium leads that constitute the couple of the Le Chatelier thermo-electric pyrometer. The object of the stand is to allow of the adjustment of these tubes to proper and variable heights and angles, and to permit the positions to be changed easily and quickly. To insert a pyrometer-couple into a furnace a hole is either drilled through the back or side of the furnace, and the tube containing the thermo-couple is introduced and left almost where it drops, for the reason that it soon becomes too hot to allow of easy handling. Again, the space at the back or side of the furnace may be so small and uncomfortably hot that easy and accurate adjustment is nearly impossible.



Pyrometer Stand.

For general work the Battersea clay tubes, made by the Morgan Crucible Co., are the best, as they are not as easily corroded and broken as the fused-quartz tubes. I had some quartz tubes, ½-in. bore and about 3 ft. long, but wished to use a longer couple, so I took the quartz tube and placed an 18-in. Battersea clay tube of the same bore, closed at one end, next to it, then slipped a piece of porcelain combustion tubing, one inch inside diameter, over the joint, and poured the space between the combustion tubing and the quartz and clay tubes full of thin plaster of paris paste.

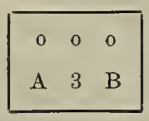
The stand is made of 1½-in. water-pipe, mounted on casters, and is heavy enough so that it cannot easily tip over. It can be adjusted to any position by being movable in three places, and it has a universal clamp which holds the clay or quartz protecting tube. To avoid disturbing the wires of the couple at the cold junction each time the tube is adjusted, the cooling bottle sets in a wire basket placed in such a way that it will move forward or back, according as the couple is moved. To overcome the necessity of leveling and adjusting a galvanometer at each



Plan of Furnace.

furnace, a switch-board is used to connect the pyrometer with the galvanometer by means of three binding-posts placed at each furnace.

The furnaces are numbered from 1 to 12, and to facilitate the work two galvanometers are used. These are lettered A and B. On each one of the blocks is a binding-post A and a binding-post B, while the third is numbered according to the furnace. Thus the binding-post block of furnace No. 3 would be



The connection between the binding-posts and the switch-board is by means of a telephone cable, cased in a lead tube, and to protect this under the furnaces it is enclosed in a conduit. The switch-board is made of marble, having a plug for galvanometer A, and another for galvanometer B, and 12 holes, each bearing the number of a furnace, so that each furnace may be plugged in on either galvanometer, or on both. To insure a perfect adjustment, the galvanometers are held in a dust-proof case, mounted on a concrete pillar 1 by 2 ft. by 4 ft. high, resting in sand about one foot below the floor. The wood base merely covers the hole in the floor at the front, back, and sides, and is fastened to the pillar, so that any motion of the floor is not communicated to the galvanometers. In calibrating the couples the readings of the galvanometer are taken through the cable and switch-board, so the conditions will be the same as when in use in the furnace.

The possibility that the rock-wall of a vein acts as a dialyzer, allowing some dissolved substances to penetrate it while confining other substances to the vein, has been suggested by G. F. Becker and discussed by W. Lindgren and F. L. Ransome. E. C. Sullivan has shown experimentally: (1) That a porous silicate filtering medium similar in character to a vein-wall removes iron from ferric sulphate solution, and (2) does not remove the acid radical; (3) that the solution takes up bases from the filter; and (4) that these bases are insufficient in quantity to have removed the iron by double decomposition. The ferric oxide studied appears to have been filtered out in a state of colloidal suspension by the fine-pored silicate mass aided by films of colloidal ferric oxide and silica.

Pressure-drop of compressed air and illuminating gas flowing in pipes, as determined by Dr. Fritsche of Dresden in 1908, is calculated by the formula

$$p = 0.0602\ G^{0.852} v^{1.852}\ L/d^{1.269}$$

where G = weight of air or gas at the initial pressure p, in kg. per cu. metre, v = velocity of flow in metres per sec., L = length of pipe in metres, and d = internal diameter of pipe in millimetres; which expresses the drop, p, in kilograms per square centimetre.

A boiler should evaporate 15 lb. of water per pound of good clean coal.

PORTLAND CEMENT.

By John L. Howard.

*What is known as 'portland cement' was not in the first instance the outcome of scientific research. The chemist did not have before him the problem of the attainment of a certain result by the combination of certain materials, nor, having a product, did he analyze it to determine its constituent parts and their proportions. It is rather the result of a series of discoveries in the practical operation of a business, and some of these were accidental in the sense that the underlying chemical reasons were not known nor understood. Rock-cements were used long before the beginning of the Christian era, but men began to understand them only about 100 years ago, and they are still striving to fathom some secrets that have not as yet been unlocked.

In the year 1756, John Smeaton, the English engineer, while seeking a more durable material for the re-construction of the Eddystone lighthouse, discovered that an impure limestone from the blue Lias formation near Aberthaw, when burned and pulverized, not only possessed the quality of setting under water, but also attained a hardness and strength far surpassing the lime mortars then known. The material was used by him in jointing the stones employed in this structure, which withstood the ravages of winds and waves for a period of 125 years. The radical departure from practice in this case consisted in discarding a mortar made from nearly pure lime-rock, and in using that from a rock made impure by a natural admixture of clay. It marked the beginning of the knowledge of hydraulic cement, and it was the ascertainment of a fact full of great commercial possibilities for commerce and of benefit for mankind; but the scientific explanation of that fact was not made until 60 years later, when Vicat, a Frenchman, demonstrated that in the process of burning, the lime combined with the silica to form silicate of lime, which is the essential basis of all hydraulic limes and cements.

Although Smeaton's discovery was the foundation of the 'natural cement' business, he seems not to have personally profited by it, for 40 years later one Parker obtained an English patent for a product which must have been similar to Smeaton's, made from the nodules of the London clay formation. Through this patent the 'natural cement' industry was launched.

In 1810 a man by the name of Dobbs obtained a patent for producing a cement, not by the use of a natural rock but from a mixture of certain proportions of carbonate of lime and clay. Here we have the first historical reference to artificial cement made by the blending of raw materials; but this and some subsequent English patents provided that none of the substances should be vitrified.

In 1824 John Aspdin discovered that there was a distinct advantage in burning the mixed raw materials to the point of incipient vitrification, and the patent granted to him covered that feature. He

*A paper read before the Berkeley Club, March 4, 1909. By courtesy of the author.

called his product 'portland cement', because of its resemblance to the English portland sandstone, but the word 'portland' when used in this connection has no other signification. In these patents exist the bases upon which both natural and artificial portland cements have since been made, but at the outset in England it required many years for the new product to overcome conservation and indurated prejudice.

Antedating Aspdin's English patent, natural cement was made as early as 1818 in New York, and it was used in construction on the Erie canal. Subsequently, as suitable deposits were discovered, cement mills were established in the New England, Middle, Southern and Western States. The first portland cement works were built in this country in 1875 by Benjamin Saylor, and in the now celebrated Lehigh region of Pennsylvania. Since then, and especially during the last decade, the business of manufacture has extended to the westernmost limits of the United States and Canada. Its development during recent years has probably exceeded that of any other business in the world, for besides the progress made in Europe, this statement finds verification in the official statistics of the United States, which show that the production of portland cement increased from 3,000,000 bbl. in 1897 to 48,000,000 in 1908. In fact, the productive capacity was so stimulated during the long period of prosperity prior to 1907, when expenditures in railroad and in other lines of constructive activity had set a new high-water mark, that it now exceeds the demand, which fell off during 1908 to the extent of 8,000,000 bbl. The industry has experienced a year of such actual loss that to prevent ruin to many enterprises, a serious and gigantic movement is now on foot in the Eastern States to remedy the evils incident to over-production. The possibilities in the development of the manufacture and in the uses of portland cement are scarcely conceivable, when one considers the strides of improvement in the making, the readiness with which the product lends itself as a substitute for other structural materials, and the widening uses to which the ingenuity of man is pushing its adaptation for constructive purposes. It is now the rival of stone, brick, and timber. The areas at present known and available containing timber and iron are the subject of much study and speculation. Their contents have been approximately determined, their annual rate of exhaustion is known, and the time limit of yield has been calculated. Certain it is, that, as this limit of life is approached, the value of lumber and steel will greatly increase, and the next generation in this country will face price-conditions not now conceivable.

Notwithstanding the recent tendency to depart from the use of perishable timber in important structural work, its consumption in the United States is now greater than at any former period, reaching the highest point in 1906, with a record of 40 billions of feet board measure. So, too, the statisticians have calculated the probable life of the iron ore deposits, and it is estimated that the duration of the high-grade supply will not be more than 50 years. But Nature has been so bountiful in the widespread distribution of minerals, that the multiplication of cement-producing plants will continue with the increasing demand for the product, and with this multiplication there will as surely follow the study and the use of every possible contrivance for the lowering of the cost. It is the ability to control the supply of raw material in the limited and favored areas containing timber and iron ore that makes possible the gigantic lumber and steel combinations, but limestone and clay deposits are so large and plentiful, and so widely scattered, as to make it inconceivable that they ever can or will come under monopolistic control, and therefore a strict monopoly of the cement business is scarcely within the limits of probability.

What is portland cement? Governments and technical societies have found it necessary to give precise definitions. They differ in minor particulars, but in substance it is described as a product formed by the fusion of only clay and lime. It is allowable to add not exceeding 2% of some substance to retard the setting, but beyond this, all additions and substitutions are to be regarded as adulterations. To make this definition more clear, the best known brands have been analyzed, and the tabulated results show that they contain:

	%
Lime	60 to 65
Silica	20 to 25
Alumina	1 to 8
Magnesia	1 to 3
Iron	1 to 4

Experience has taught the manufacturers that a good and uniform product depends on keeping within these ranges of composition. The lime is found in deposits of chalk, marl, and both pure and impure limestone. The silica is obtained from beds of shale and clay which contain in combination the alumina, magnesia, and iron. When the clay and lime are found combined as a natural deposit, and without being first ground and chemically corrected, they are calcined and pulverized, and the product is known as 'natural cement,' but the quality is neither high nor uniform, although it must be said there are examples of very durable work made with that material. The American 'rosendale' and many of the Belgian cements are of this character. But where the raw materials are assembled and adjusted to set rules of proportions, pulverized, burned, and reground, the product is termed artificial or portland cement. These are the distinctions recognized in the trade.

In the earlier history of the industry, and indeed until quite recently, portland cement was made by what was known as the wet process. In this the raw materials were mixed in water, and the 'slurry' was run into settling ponds or vats. After the sedimentation had taken place, the clear water was run off, and the remaining moisture was partly evaporated by natural or artificial heat. The cake, sometimes pressed, was then stacked in alternate layers with coke, in vertical kilns. When the kilns had been fired sufficiently long, they were cooled and drawn, and the properly burned 'clinker' was sent to the

mills for grinding into cement. This process was intermittent, laborious, and expensive, and the product was not uniform in quality.

But there came a revolution in method due to the introduction of the dry process, which met with the head-shakings of doubt and the opposition that are usual when established practice faces untried ideas. The new process being continuous and more economical, it prevailed, and compelled an abandonment of the older methods. Before starting a cement industry it must be assumed that there has been found abundant limestone and clay. To avoid mistakes, the prudent investor will submit the raw materials to chemical analysis, to determine their suitability for cement-making. He will also have practical tests made to ascertain the quality of product that may be made from it. If the results are satisfactory, the problem is then submitted to the cement engineer, who fixes the site for the plant, designs the buildings and accessories, selects the modern types of machines for each part of the process, and carries construction to completion.

In actual manufacture the lime rock is crushed at the quarry and this and the clay from the bank are transported to the mill, and deposited separately in storage bins. Each is thoroughly dried and then roughly ground in a ball-mill, that is, a rotating cylinder partly filled with steel balls; and the dried materials are there reduced to the condition of coarse sand, and stored separately.

At this point occurs the first critical work of the chemist in the laboratory. Variations of moisture having been eliminated, he must constantly analyze these dried materials, and converting terms of percentage into terms of weight, calculate such a mixture as will conform to the proportions needed to furnish the desired product. Carelessness at this stage is fatal to good quality. After this first reduction the mixture is passed into tube-mills, which are likewise rotating cylinders partly filled with steel balls and flint pebbles, and in them the grinding is completed, and the mixture is reduced to the condition of fine flour.

The intimacy of mixture and the fineness are essential to the success of the next process, which is burning. This is performed in what are known as rotary kilns, which are slowly rotating cylinders, some as long as 150 by 8 ft. diam., lined with thick fire-clay blocks, and slightly inclined from rear to the front. The pulverized raw material is automatically fed in a regulated quantity into the rear of the kiln, and in its slow progress toward the front, it passes into a constantly increasing temperature due to the combustion of pulverized coal, crude oil, or natural gas. The heat first dissipates the residual moisture, then the carbonic acid gas, and lastly it fuses the lime with the silica and other minerals to form a new compound, an alumina-silicate of lime.

This red-hot semi-fused product, in the shape of coarse sand, and of lumps varying in size, is ejected from the kiln, and in this form it is known as 'clinker.' The theory, and the effort, is that all the lime and all the silica should be made to combine, and the previous fine-grinding and thorough mixture were for the promotion of this union, but in fact this completeness of fusion is not realized, neither is uniformity of burning accomplished. For although the quantity of material fed to the kilns is automatically regulated, and the speed of rotation is mechanically governed, the burning is not under exact or instrumental control. The eye directs the judgment of the skilled attendant, who, watching the incandescent flame through smoked glasses, cannot detect variations at high temperatures. Sometimes clinker is over-burned when the vitrification is carried too far, in which case the product has no value as cement; at others it is underburned, where the fusion has not been carried far enough, but in either case it is not possible to make any separation of the bad from the good clinker, all must go together, and if there be enough of the bad material it will be reflected in the quality of the final product. It was the invention of the rotary kiln that worked the revolution in the process, and permitted the manufacturers to use the continuous dry system.

The clinker is next subjected to the influence of cold air blown through a cooler, sprayed with water, and stored under cover or in the open for seasoning through exposure to the atmosphere. This has the effect of decrepitating the lumps, and if uncombined or free oxide of lime be present, it is converted into the hydrated form, and thus rendered inert and harmless. The seasoning process being completed, the clinker is passed through ball and tube-mills, which complete the grinding, and thence, as finished cement, it is conveyed to the stock-house for storage and further seasoning prior to packing for shipment.

In this brief and general description it will have been noticed that a cement mill is a huge laboratory for the manufacture on a large commercial scale of the alumino-silicate of lime, and it will be difficult to find an industry in which the skill of the engineer has been more effectively used for the elimination of human labor. It requires approximately 700 lb. of raw material to produce a barrel of 400 lb. of cement, so that in a mill of 5000 bbl. capacity, 1750 tons of lime rock and clay must be treated daily, and yet so complete are the mechanical arrangements that this volume of material is not touched by hand from the time it leaves the quarry until it is delivered into the sacks ready for sewing. It may also have been observed that the quality is largely dependent upon the chemist. Day and night he is at work in the laboratory on periodical chemical tests of raw material; for unless that be kept in close conformity with a set standard, the resultant product will not meet the requirements of the subsequent physical testing to which it is constantly subjected. So important is this, that the National, State, and municipal governments, as well as the technical societies, have prescribed, not only standard rules for making physical tests, but also the standard results that must be obtained from those tests, and cements that do not meet the specifications of the American Society of Civil Engineers, for example, are properly rejected. The manufacturers of cement have this knowledge, and for the most part follow the requirements in their laboratory practice. This being so,

there is no reason excepting cupidity for the shipment of cement, which shall be found wanting when weighed in this balance. Regardless of brand, name, and reputation, all cement should be tested, and this necessity increases with the importance of the work. Faulty cement should be rejected, and its use should be officially prohibited. Through ignorance, carelessness, or dishonesty, good cement will often yield poor results. It is the smallest, but the most important of the constituents of concrete, but where there has been an utter disregard of proportions, or of the character of the rock, gravel, sand, or water with which it is associated, good concrete cannot be made, and if not made, the fault is laid at the door of the cement, which has not been given the 'square deal.' On the part of the investigators the logic of their formula is, that in concrete certain results should be yielded by the cement.

A long series of tests made with well known brands of good reputation have yielded certain results. Therefore any cements, which upon being tested in the same manner will give equal results, may similarly be considered good, and as meeting the specifications.

The routine tests are:

Soundness.—For the detection of free or uncombined lime; which when present in important quantity will cause expansion and destroy the constancy of volume of the work made from the cement. Chemical analysis will not distinguish between the lime which is free, and that which is combined. A severe test is to fill a tube with paste, and the expansion of the free lime will cause the glass to crack. The ordinary method is to make pats of neat cement on glass, and expose them to vapor and water-baths, which will cause unsound cement to display cracks and distortions. The causes may be the disproportions, the lack of fineness, or the incompleteness of the mixtures, of raw material, or it may be improper fusion. The remedy lies partly in the seasoning of the clinker and the cement in order to render harmless the oxide of lime.

Fineness.—It is required that no less than 92% by weight shall pass through a 100-mesh sieve, nor less than 75% through one of 200-mesh. Chemists do not yet know at what point in fineness the cement begins to develop cementitious value. They do know that the particles which fail to pass through the sieves will not of themselves set; and they know that if these particles be re-ground they will harden. Some theorists contend that only about 10% of the material is of the fineness to have any value, and that the balance is useful only as so much sand to fill the voids. The Germans were the first to discover the effect of fineness on quality, and the English manufacturers were compelled to follow their practice in this regard.

Tensile Strength.—This test is made by the breaking of briquettes formed in standard molds where the mid-cross section is exactly one square inch. Neat cement paste, and that made by a mixture of one part of cement with three parts of standard quartz-sand, is forced by finger-pressure into molds, and when released is kept first in air and afterward in water, and a pair of briquettes is broken at 1, 7, and 28 days, and also at longer intervals. The machine used exerts a constantly increasing power to pull the briquette apart, and when the fracture occurs, the amount of strain exerted is indicated. The specifications require that the tensile strength shall be within the following limits:

	Neat, lb.	⅓ sand, lb.
24 hours	150 to 200	.....
7 days	450 to 500	150 to 200
28 days	550 to 650	200 to 300

It is also required that with age there shall be no retrogression in strength.

Compressive Strength.—Although for the most part concrete as a weight-sustaining body is subject to compressive strains, this test is not currently made because of the cost and cumbersomeness of the apparatus, and the consumption of time, it being assumed that the compressive strength is equal to about eight to ten times that shown by the tensile tests.

In concluding this brief review of the history, processes, and quality determinations, it may be said that after all these years of experience and research, there is much about this sensitive and delicate product that is mysterious. There is no certain knowledge as to the functions performed by the various ingredients that enter into its composition, nor precisely what occurs in the process of setting, nor what degree of fineness is necessary to make it entirely valuable, nor why with age weak cements will sometimes increase, and at other times strong cements will diminish in tensile strength, but it is almost certain that their secrets will be revealed, and that human ingenuity will enable the maker to have as much control over the product as the metallurgical chemist now possesses over the quality of steel. Ultimately cements will be made to exactly meet every special need either above or beneath the water or the earth.

Throughout historic time the styles of architecture and the modes of construction have been determined by the character of the available structural material. The early Egyptians living at the mouth of the Nile, used bundles of reeds, placed vertically and horizontally, and plastered with mud. This was the use of the beam-principle. Later through the dispersion of population they came in contact with the limestones and granites of the Upper Nile, and these were substituted, but the same beam-construction was employed, which found its highest expression in the temples of worship. The Assyrians at first occupied the treeless and stoneless alluvial plains at the mouths of the Tigris and Euphrates, had recourse to the available clay which they converted into sun-dried and vitrified bricks, and these were structurally employed in styles suitable to their character. There is some evidence, however, that the use of these small units enabled them to construct the arched vault. Later the discoveries of stone permitted its substitution as a building material, and brought about a change in style and in structural methods. Through the employment of the Pentelian marble the Greeks continued the use of the column

and beam-principle, but the Romans were the first to combine the column and the arch, and this is said to have been due to the use of the plastic material known as roman cement, not cement in the sense we now understand it, but a mixture of lime-putty, quarry-chips, and a sharp volcanic sand obtained on the shore of the bay of Naples. This mixture was deposited within wooden forms for the making of arches and walls, precisely as cement is similarly used today. It had the property of hardening, and was faced with other material. They were, however, prodigal in its use, as for instance the Roman Pantheon, with a diameter and height of 142 ft., has walls 20 ft. thick. The spread in the use of the Roman arch was owing to the constructive activity of the Romans throughout their conquered provinces, and the modifications of it may be traced during the early centuries until the Medieval Gothic cathedrals rose in stone to attest the skill and boldness of design, the marvelous beauty of execution, and the religious zeal that prompted it all. And so in all times brick, stone, timber, and steel, alone and in combination, according to availability and cost, have locally determined the constructive materials and their methods of application.

But within the present generation there has been made an important discovery in physics, namely, that steel and cement-concrete expand and contract in the same ratio. The application of this fact meant that when steel bars were embedded in concrete, there was an adhesion to them of the cement, and they became not separate strengthening units, but were incorporated and made part of the mass, thereby imparting to it the tensile strength which is lacking in the concrete itself. This has made possible the construction of buildings that are practically monolithic, where foundations, walls, partitions, floors, and roofs are armored concrete, from which there is eliminated all other structural material, save the metal used in the doors and windows.

In the process of hardening, the theory is that crystallization occurs and proceeds in all directions, and thus, in this artificial stone, homogeneity exists instead of the lamination that is common to many varieties of building rock. Cement concrete possesses undoubted fire-resisting qualities, and during the period of its use it has shown itself capable of withstanding the action of the waves and of the elements. It is possible to make it both damp and waterproof. Those deft artificers, the Italians, are making it serve the highest purposes of building ornamentation, as well as extending it into every possible channel of common utility. They have constructed and are using harbor barges, or lighters, capable of carrying as much as 250 tons of cargo.

The railroads are experimenting with armored cement ties, which as yet have not been made to meet all the required conditions. In the irrigation schemes the Government has found it to be effective in the construction of reservoirs and dams, and as lining in the miles of canals and ditches to prevent loss by seepage. It lends itself to the construction of telegraph poles, wharf-piles, fence-posts, and in many other directions as an imperishable substitute for wood. Its use is becoming general in the erection of industrial establishments and of tall chimneys, and with it the engineers have been enabled to modify the form of bridge-arches, for nothing is more durable, and no designs of bridges are more graceful and pleasing to the eye than those of modern construction through the use of steel reinforcement in cement-concrete. It would serve no good purpose to continue the enumeration of its uses and substitutions. In the past the changes in structural styles and methods were slower than the reading of history would seem to indicate. But the marvelous strides made in so few years by this relatively new material leads to the reflection, that in this department of activity we have passed the beginning of another era of change, and that future generations may mark this epoch just as those of our day have noted the revolutions in the past.

Laboratory determinations of volatile matter in coal serve as a more or less valuable indication of the adaptability of the coal to industrial uses either for combustion, destructive distillation, or gasification. The method for this determination is, however, arbitrary and does not duplicate closely that of any industrial operation. Furthermore, the results by the laboratory method are sensitive to varying conditions and the influence of such variation on the character of the volatile products has not heretofore been the subject of extended study. The importance of the rôle played by the volatile matter in industrial applications of fuel is generally recognized. There are more heat units in the volatile matter in proportion to its weight than in the fixed residue. Pittsburg coal of 30% volatile matter and 7 ash has 36% of its heat-value in the volatile matter. When coal is fired under a boiler either by hand or mechanically, it first undergoes a process of distillation, and both the quantity and quality of the volatile products and the relative ease of their liberation, are concerned largely in the boiler-efficiency and the production of smoke. The low-temperature gases given off are high in illuminants and the higher homologues of methane, and low in hydrogen. At about 500° C. the tarry products are evolved in greatest quantity, as well as the illuminants. The amount of CO steadily increases with rise in temperature; and the same is true of CO_2. The smokeless character of a coal seems to be closely related to the presence of considerable hydrogen in the volatile constituents evolved at low temperatures.

Efficiency of a dryer is the theoretical heat required to do the drying, less the loss of heat. These losses are but three, the greatest being the heat carried out by the exhaust or waste gases; this may be as great as 40% of the total heat from the fuel, or, with a properly designed dryer, be as small as 8%. The next greatest loss is by radiation from shell or walls. This may be as high as 25%, or as low as 4. The smallest loss is due to unnecessary heat carried away by the dried material. This may amount, under certain conditions, to as much as 25% or as low as nothing. Whatever loss there is, however, is generally due to careless operation.

COMPANY REPORTS.

OOREGUM GOLD.

The report of the Ooregum Gold Mining Co. of India, Ltd., for 1908 shows it to be in good condition. The Ooregum mine is in the Mysore district and is under the management of John Taylor & Sons, with R. H. P. Bullen as resident superintendent. Within the year 121,886 tons of ore were crushed with a production of 73,871 oz. gold. There was a further saving of 12,131 oz. from the cyanidation of 108,869 tons of tailing. In addition 250 oz. were reclaimed from an old mill which was dismantled. This was an increase of 12,690 oz. over the preceding year. The total dividends for the year amounted to 32½% on the preferred and 22½ on the common shares. In addition £25,841 9s. 1d. was paid on capital account, £20,000 appropriated on the Bullen shaft account, £7624 10s. 11d. set aside for depreciation, and £3754 for income tax. The profit and loss account showed a balance of £4455 10s. 8d., as against £3168 15s. 7d. at the end of 1907. Ore-reserves are estimated to have been increased 10,293 tons and to now amount to 154,281. The yield per ton milled was 11 dwt. 0.18 gr., and per ton cyanided 1 dwt. 21.25 gr., an improvement of 1 dwt. 22.93 gr. Experiments are being made with the Ridgway filter in a slime-plant.

MOUNT BOPPY.

The mines of the Mount Boppy Gold Mining Co., Ltd., are situated in New South Wales and are under the management of John Taylor & Sons. The production for 1908 amounted to 34,136 oz. fine gold, equivalent to 9 dwt. 19.57 gr. per ton crushed. The total dividends were £57,475, equivalent to 47½%. The ore treated was 6782 tons less than in 1907, but the recovery came to 2534 oz. more. James Negus, the manager, computes the payable ore-reserves to be 126,850 tons. Within the year the total tonnage crushed was 69,715; tailing cyanided 48,558; slime 27,540; concentrate sold 255; total fine gold production, 34,136 oz. The vein varies from 5 to 60 ft. in width, and consists of quartz traversing slate. It carries gold in extremely fine state of division with galena and blende. Oxidation has taken place to nearly 400 ft. in depth. Development extends to 500 ft. The average yield per ton of ore crushed in 1908 was 11 dwt. 8.25 gr. fine gold. Since milling began in 1901, 358,577 tons have been crushed. The total amount realized has been £733,811 10s. 7d., of which £319,757 13s. has been paid in dividends.

BANTJES CONSOLIDATED MINES, LTD.

The report at hand covers the period from the resumption of operations in August to the close of 1908. W. W. Mein, consulting engineer, reports that re-sampling of the South Reef in the eastern section, completed in February 1909, showed the presence of 150,660 tons of payable ore with an average value of 8.7 dwt. No sampling has yet been done on the other reefs in the property, but the results are believed to be sufficient to warrant vigorous prosecution of the work. By the re-organization £140,000 became available. With this liabilities have been liquidated and the mine is to be re-opened. A 35-stamp mill is being built and is expected to be ready for operation by May. The proceeds from milling operations are to be used for the next year in further development.

VOGELSTRUIS CONSOLIDATED DEEP, LTD.

The Vogelstruis was re-organized in August last year, with a reduction of £294,750 in capital. It has now 299,900 shares of £1 value, of which 70,650 are held in reserve. There is £70,600 outstanding in 6% debentures and the company now has £107,513 cash on hand. The property is being re-opened, work having been begun in October. A 40-stamp mill has been ordered and is expected to be in operation in May. According to S. C. Thomson, consulting engineer, the payable ore-reserves now amount to 91,923 tons, having an average value of 8.94 pennyweights.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

CONTRACT FOR DRILLING COAL LAND.

A contract for drilling coal land stipulated for the payment of a certain price per foot up to a given depth if coal was not reached before that depth; it also stipulated for the payment of the same price if it was necessary to go to a greater depth. In an action to recover on the contract by the driller, the court held that the contractor's right to recover was not dependent on striking coal; and especially where it appeared that payments for work done had been made as though striking coal was not a condition precedent.

Western Fuel Co. *v.* Fuller, (Ark.) 113 Southwest. 1021, Nov., '08.

ADJACENT CLAIMS—DEVELOPMENT WORK.

Where several persons hold separate but adjacent mining claims, and work beneficial to all can best be done on one of them, under a proper agreement between the owners the development work can all be done on one and credited to the several claims, where such work constitutes a general plan or scheme for the development of the several claims. It is the rule that development may be done outside the limits of the claims, and may be credited thereon if beneficial to all the claims for which the credit is asked, provided the claims are held in common.

Hawgood *v.* Emery, (S. Dak.) 119 Northwest. 177, Jan., '09.

LIABILITY FOR INJURY TO EMPLOYEE.

Where a contractor was working a portion of a mine under a contract with the owner under which he mined the ore at a stated price, and the owner retained control of the mine and had the duty of inspecting and keeping the mine in safe condition, an employee of such contractor was not a trespasser, nor a mere licensee, but was said to be there by invitation of the owner, and as to him the owner must exercise ordinary care and prudence to render such mine reasonably safe.

Tennessee Coal, Iron & Railroad Co. *v.* Burgess, (Ala.) 47 South. 1029, Dec., '08.

WARRANTY—CONSIDERATION.

A deed purporting to convey certain real estate particularly described, recited, immediately after the description, thus: "The right and title to the surface soil thereof, with its appurtenances appertaining thereto, except the mining privileges thereof;" and this was followed by the usual words of warranty. Under this deed it was held that no claim to the mining privileges and rights in the land could be asserted by the successors in interest of the grantor after a period of nearly 50 years, and after both grantor and grantee were dead. The provision as to the mining privileges was construed as a mere limitation on the covenant of warranty, and not as a reservation to the grantor of the mining rights in the land.

Towns *v.* Brown, (Ky.) 114 Southwest. 773, Dec., '08.

FORFEITURE OF CLAIM—DEVELOPMENT WORK.

One of two partners or owners in common of two or more claims cannot prevent a forfeiture of rights by a co-partner by showing that he had performed work on adjacent claims, beneficial to the claims in litigation, he being the sole owner of a part of such adjacent claims, and the owner in common with third persons of the other claims on which the work was done, if no agreement exists between them for doing such work, or unless a sufficient showing can be made that the work was part of a general plan or scheme for the development of the claims owned by such partners in connection with the claims on which the work was done. The reason is that one partner cannot, in the absence of an agreement, perform work on property in which his co-partner is not interested, and hold his co-partner liable therefor.

Hawgood *v.* Emery, (S. Dak.) 119 Northwest. 177, Jan., '09.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

HANDBOOK ON AMERICAN MINING LAW. By Geo. P. Costigan, Jr. 8vo., pp. 765, index. West Publishing Co., St. Paul, 1908. Price $3.75.

This work is a valuable addition to the literature of mining jurisprudence. The author has entered into the spirit of Western mining law and his treatment of the subject gives evidence of being the result of honest and painstaking labor. One can hardly agree with Costigan in his belief that Belk *v.* Meagher (104 U. S., 285) "was wrongly decided," and that Lavagnino *v.* Uhlig (198 U. S., 443), which is inconsistent with the former case, is the better doctrine of the two. The recent case of Farrell *v.* Lockhart (210 U. S., 142) has had the effect of re-instating the doctrine of Belk *v.* Meagher, and again giving full force and effect to the rule that a re-location made while a valid and subsisting senior location covers the ground is void and, in order to secure any right to the senior claim, a person who intends to re-locate must wait until the senior claim has been abandoned or forfeited. (See discussions of this question in MINING AND SCIENTIFIC PRESS, Vol 94, pp. 212, 695, and 751.) Nor are his definitions of 'shaft' as being "a *perpendicular* excavation," and of 'chimney' or 'chute' of ore as being "a *perpendicular* enlargement of the orebody," strictly accurate. It is easier, however, to tear down than to build up, and it would not be fair to Costigan to leave one with any other idea than that he has produced a comprehensive and up-to-date work on a subject that is highly specialized. The book is intended for students as well as for practitioners, and it should be found on the shelves of every person interested in the subject of mining law.

HEAT ENERGY AND FUELS: PYROMETRY, ANALYSIS OF FUELS, AND MANUFACTURE OF CHARCOAL, COKE, AND FUEL GASES. By Hanns v. Jüptner, translated by Oskar Nagel. 8vo., pp. 306, Ill., index. McGraw Publishing Co., New York. 1908. Price $3.

The work of so distinguished a man as Prof. Hanns v. Jüptner is certain to be solid, and examination shows that no general dissertation has been relied upon, after the manner of those who are mere makers of books. As a discussion of methods of heat-measurement this book is one of the best condensed statements we have seen, and the same will apply to the extensive chapter on calorimetry. The book is one adapted in this particular for general use and for purposes of instruction. Half of the treatise is taken up with a discussion of various fuels and methods of utilization. There are chapters on the different kinds of coal, peat, briquetted fuels, liquid fuels, producer gas, water gas, and blast-furnace gases. The best of these deal with coal and producer-gas. The contribution to knowledge of liquid fuels is so trivial that it might as well have been omitted. In fact, the book is of value especially for its discussion of estimating heat-values of fuels by pyrometry and calorimetry.

ENGINEERING INDEX. Annual for 1908. 8vo., 437 pp. New York, Engineering Magazine, 1909.

This represents the continuation of work started by J. B. Johnson in 1884 and followed since 1895 by the *Engineering Magazine*. It is the third annual volume. The attempt is made to cover the whole engineering field, with the result that while over 8000 entries are made there are, for example, only six for gold and silver in Colorado, and one of each for California and Alaska. Australian zinc is dismissed with two titles, and Mexican with one. Wisconsin, under this subject, receives no notice. Any one familiar with the literature of the subject in 1908 will recognize that the mining titles are not only too few, but poorly chosen. Inconsequent articles are allowed to crowd out others of larger import. Presumably the other portions of the index are better done, as they are fuller, but for mining engineers, at least, the book is important mainly as a guide to related subjects. The work is evidently too large to be properly carried out with the means employed.

ACCIDENTS AND EMERGENCIES: A MANUAL OF THE TREATMENT OF SURGICAL AND MEDICAL EMERGENCIES IN THE ABSENCE OF A PHYSICIAN. By Charles W. Dulles, M. D. 7th ed., 8vo., pp. 205, ill., index. P. Blakiston's Son & Co., Philadelphia, 1909. Price $1.

One important function of every mine manager is to serve as physician and surgeon in emergencies; every man on the frontier of civilization needs to prepare himself to render service of that kind. Indeed the knowledge of effective first-aid to sufferers is useful to every man, whatever his environment. The little manual by Dr. Dulles is one of the most comprehensive of its class; written in lucid simple language, with instructions given in that definite form which is essential for application by laymen. The illustrations are most helpful, and the key to the subject-matter by table of contents and index renders it instantly serviceable. It should constitute part of the equipment of every miner.

PRACTICAL CALCULATION OF TRANSMISSION LINES, FOR DISTRIBUTION OF DIRECT AND ALTERNATING CURRENTS BY MEANS OF OVERHEAD, UNDERGROUND, AND INTERIOR WIRES FOR PURPOSES OF LIGHT, POWER, AND TRACTION. By L. W. Rosenthal. 8vo., pp. 93. McGraw Publishing Co., New York. 1909. Price $2.

There is no waste space in this volume. It is a calculator's assistant, pure and simple. The elements of the problems in current transmission are all given, but in the briefest form. For example, in the first chapter the subheadings are: properties of conductors, discussing both copper and aluminum, current-carrying capacity, parallel resistance of wires, together with tables embracing ampere-feet per volt drop and current-carrying capacity, and so forth. The book is made up of formulas, tables, and practical examples.

LAW AND BUSINESS OF ENGINEERING AND CONTRACTING. By Charles Evan Fowler. 8vo., pp. 162, index. McGraw Publishing Co., New York. 1909. Price $2.50.

The title of Mr. Fowler's book is misleading, very little space being devoted to legal matters. As an engineer of wide experience he has accumulated valuable information on the drawing of contracts, in the making of specifications, estimates for materials, inspection, and the like. These are the subjects treated, and within the limits of a small volume they are exceptionally well set forth. The example of specifications of structures chosen is for roofs and buildings, which will appeal to a wide range of engineers. The methods of inspection for structural steel is given in outline, sufficient to guide an engineer in making contracts for such supplies. Cement testing is given in detail. It is a useful work.

THE MINE INVESTOR'S GUIDE. By Floyd Davis. Small 8vo., pp. 168, ill., index. Western Correspondence School, Des Moines, Iowa, 1909. Price $1.50.

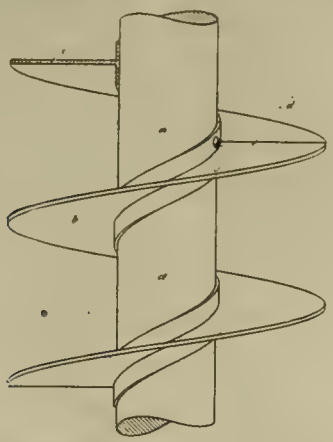
Elementary disquisitions on mining are usually addressed to prospectors; this is a bow to the capitalist—we can scarcely call it a 'tip.' The random shots at miscellaneous, geological, mining, and metallurgical matters could serve only to give a clouded view. Elucidation, there is none. We cannot discover a useful function which the book might perform.

BIBLIOGRAPHY OF THE GEOLOGY, MINERALOGY, AND PALEONTOLOGY OF BRAZIL. By J. C. Branner. Bull. Geol. Soc. Amer., Vol. 20, pp. 132.

MINERALS OF ARIZONA. By W. P. Blake, Territorial Geologist. 8vo., 63 pp. Tucson, 1909.

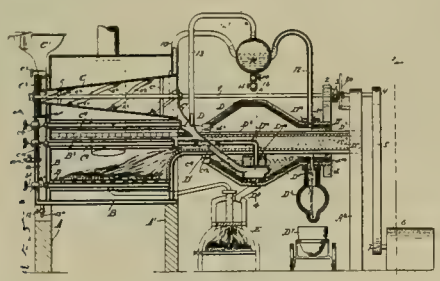
MINING AND METALLURGICAL PATENTS.

CONVEYER-SPIRAL.—No. 915,702. Wilhelm Schroer, Dahlerbrück, Germany.



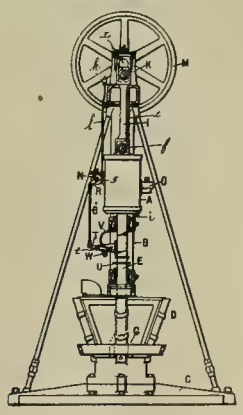
A conveyer spiral consisting of a screw blade extending around a shaft for more than a full pitch and of a spiral base integral therewith in T-shape adapted to fit over a shaft, and having only half the thickness of that of the screw blade.

ORE-SMELTER.—No. 916,176. Ezra A. Mathers, Philadelphia, Pennsylvania.



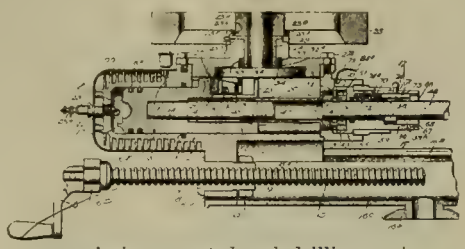
A smelter comprising a furnace, a rotary roaster directly above and in the same casing with said furnace, a smelter arranged adjacent to the casing containing said furnace and roaster and in a single structure therewith, said structure being formed with an ore-conduit leading from said roaster into said smelter, said several parts being arranged to cooperate continuously, substantially as set forth.

ATMOSPHERIC STAMP.—No. 915,362. Charles H. Krause, Keweenaw Bay, Michigan.



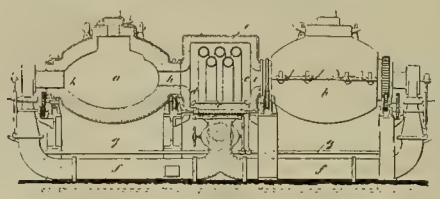
In an atmospheric stamp the combination of a cylinder, a mechanically operated piston and an atmospheric piston in the cylinder, a pestle connected to the atmospheric piston, an inlet and an exhaust for the cylinder, an oscillating valve and a check valve controlling the inlet port, means for mechanically operating the oscillating valve, and an adjustable check valve controlling the exhaust port, the exhaust port leading from the cylinder near the end of the stroke of the atmospheric piston during which the atmospheric piston leads, whereby during the first part of such stroke the air under pressure between the pistons may be retained and raised to a high pressure to insure a heavy blow by the pestle.

GASOLENE-OPERATING ROCK-DRILLING ENGINE.—No. 915,320. Rolland S. Trott, Denver, Colorado.



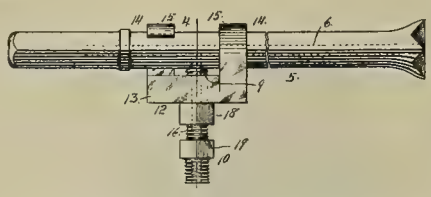
In a gas explosion operated rock-drilling engine, a cylinder, a crank chamber adjacent to said cylinder, apertured lugs at the rear end of said crank chamber, a piston mounted to reciprocate in said cylinder, having thimbles adapted to enter said apertured lugs, and thus cushion the rear stroke of the piston, a swinging plate on said piston cushioned at one end within one of said thimbles, a fixed plate adjacent to the swinging plate, and a fly wheel having a crank pin adapted to move between said fixed and swinging plates.

SMELTING-FURNACE.—No. 915,192. August Koch, Hanover-List, Germany.



An oil heated smelting furnace comprising a plurality of rotatable chambers adapted to operate alternately as smelting or as preliminary heating chambers, and a fuel vaporizing and air heating compartment connecting said smelting and said preliminary heating chambers causing the combustion gases to first pass directly from said smelting chamber into said heating compartment, and thence directly to the other chamber used at the time as preliminary heating chamber for the material to be subsequently smelted.

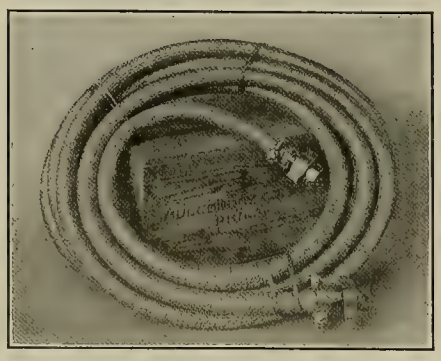
WATER ATTACHMENT FOR DRILL-STEELS.—No. 915,230. James H. Sinclair and Guy D. Neill, Denver, Colorado.



In a water attachment for rock drills, the combination with the drill steel having a central longitudinal passage open at the forward or cutting extremity of the steel, its rear extremity being closed, the steel having a transverse orifice communicating with the longitudinal opening, and a drill steel holder comprising a base having a threaded opening and two outwardly projecting hook-shaped members projecting from opposite sides of the base, their hook-shaped extremities projecting over the drill steel in opposite directions, and a nozzle screwed into the opening in the base of the holder and arranged to engage the drill steel whereby its passage is caused to register with the transverse orifice of the drill steel, substantially as described.

New High-Pressure Hose.

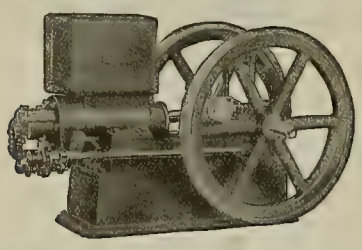
The Mulconroy Co., Philadelphia, is the manufacturer of a new type of high-pressure hose which is made to withstand working pressures of air or water up to 10,000 lb. per square inch. This hose, because of its peculiar construction, is claimed to possess distinct advantages for certain classes of service. It is covered by a metallic surface composed of fine galvanized-iron wires, arranged in strands of seven wires each. Two series of strands are used, one forming the right-hand, and the other the left-hand spirals around the hose. Each strand passes alternately over and under the strands wound opposite to its own direction. The pitch of the spirals on the usual size of hose is about 1¾ in., giving ten strands to each series. The wires in each strand lie flat, side by side, so that a smoothly woven, flexible, metallic



covering is formed around the inner tube. The inner tube is of the ordinary rubber and fabric construction. The metallic covering relieves the inner tube from the severe tensile strain due to high internal pressure, and also protects it from wear and abrasion. The ½-in. hose may be bent to a 3-in. circle without kinking. The strength afforded by the covering makes it possible to reduce the number of plies in the inner tube, and for this reason the metallic hose can be manufactured at a cost slightly less than that for high-pressure hose with a fibrous covering. With a single covering the hose can be used for working pressures up to 1000 lb. per square inch, and for higher pressures additional layers of metallic covering are added.

New Hopper Cooling Plan for Gasoline Engines.

The well known principle of maintaining a moderate temperature on gasoline engines has heretofore been through the use of a large water tank or pump, which has the disadvantage of increasing the weight, or being cumbersome, and of requiring a great deal of water for cooling. It is necessary in a gasoline engine to have a circulation of

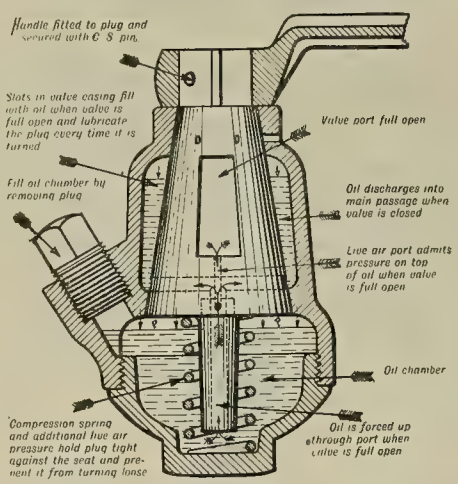


water around the cylinder to prevent overheating and to maintain a moderate temperature, so as to avoid ignition of the fuel before the proper time; this is why the water is used for cooling.

The new hopper principle consists of making a cast-iron hopper in box form, placing it over the cylinder, and holding the water directly over the cylinder for cooling purposes. The principle of the teakettle again comes into effect. The open top of the cylinder and the open hopper permit evaporation; the steam condenses quickly and comes in contact with the open air immediately; consequently water exposed to the open air cools 20 to 30 times faster than water enclosed in a jacket. For that reason a hopper-cooled engine can be cooled with from 20 to 30 times less water than is used with the average engine using a water tank. It reduces the weight of the equipment, saves the water, avoids draining or handling a large amount of water in cold weather, and consequently avoids the usual danger of freezing. The cut herewith shows a Witte hopper-cooled gasoline engine, made by the Witte Iron Works Co., Kansas City, Missouri, which illustrates the simplicity of the hopper-cooling plan. In this case the hopper is built separate from the cylinder, so that it can be removed. A plate will be furnished in exchange for the hopper any time a user may desire to employ the water-tank principle in place of the hopper. The side of the hopper is also arranged for pipe-connections. The hopper-cooled engine has become popular, and is of interest to all who contemplate the use of a gasoline or kerosene engine. Whether the engine be used in a shop or for outdoor work, the principle and the convenience have the same advantages.

Self-Lubricating Stop-Cock.

The need for a simple device that combines an automatic oil-feed with a stop-cock has long been felt by users of rock-drills, coal-punchers, and air-hammers. The problem has been solved successfully by the D. D. Demarest Co. of San Francisco in the Pacific lubricating stop-cock. Without any additional wearing parts, it provides a means to lubricate the valve itself and to feed a pre-determined amount of oil to the machine every time the valve is closed and opened. There are no parts to get out of order, and as the working surface of plug and casing are always oiled, this valve will outlast several of the ordinary stop-cocks. It prevents



waste of oil which would, in the old way of oiling the machine, get into the ore, and in gold mines would cause considerable trouble and losses in amalgamation. Every drop of oil that passes through the valve is properly used in the machine, thus always providing a perfect lubrication of the interior working parts of the drill to which it is attached. The life of the machine will therefore be greatly increased and the cost of the valve saved many times. The cut shows the construction. A compression-spring and the additional live-air pressure in the oil-chamber force the valve-plug tightly into its seat, and besides preventing the leakage of air from the supply-pipe, holds the valve-plug and the handle securely in any desired position. To secure a convenient and practical connection between the machine and the supply-hose for the different makes of rock-drills, stopers, and air-hammers, six different types in as many different sizes, have been adopted.

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EDITORIAL.

A NEW gold-dredging field is being worked in a quiet way in Africa. Some Australian prospectors discovered placers about two years ago at Kilva, in the northeast portion of the Congo Free State. The work is being conducted on Government account and the shipments of bullion are said to exceed $200,000 per month.

PLANS for the work of the State Mining Bureau as announced by Mr. Lewis E. Aubury include special investigations of the petroleum and gold dredging industries. We are glad to note that sufficient funds are now available to permit of good work. There is ample field in California for the services of a large and active Bureau. That the work has not been satisfactory in the past is well known. With adequate money and with Mr. Frank W. Griffin on the Board of Trustees, an extremely valuable report on gold dredging ought to be forthcoming.

LADY BRASSEY in her 'Sunbeam Voyage' wrote that a *real* octopus is worth from a dollar to a dollar and a half. Evidently we have not the real thing at 26 Broadway, New York—only a spurious octopus. It is not worth as much as Congress thought. With jubilation the festive lawmakers placed crude oil on the free list, when lo! the multitude of pollywogs, supposed prey of the greedy cephalopod, displayed alarm, and made a great disturbance. It turns out that the pollywogs produce 89 per cent of the crude petroleum of the country. It is refreshing to find that Standard Oil does not own the country after all.

MISSOURI is still without a successful gold mine. Mr. H. A. Buehler, the capable State Geologist, finds himself unable to confirm the glowing report furnished by Mr. A. M. Beam on the property of the Boone-Baldwin Pioneer Gold Mining Co. at New Cambria. Careful sampling and assaying failed to develop even a trace of gold and silver, and only the usual coal-measures, with a little pyrite and calcite, were found in the shaft. The so-called "large section of feldspar" is an area covered with drift and showing surface boulders of greenstone and granite. Even the boulders were perverse and failed to show a trace of the precious metals. We only wish that Beam and others of his ilk were as transitory as these short-lived mines.

THE DOCTRINE of a living wage has received official sanction from Mr. Justice Higgins of the Commonwealth Court of Conciliation and Arbitration. The decision was in settlement of the Broken Hill wages dispute. In the following words he gave one of the clearest statements of the doctrine we have seen: "The first condition in the

settlement of this dispute as to wages is that at the very least a living wage should be secured to the employees. I can not conceive of any such industrial dispute as this being settled effectively, which fails to secure to the laborer enough wherewith to renew his strength and to maintain his home from day to day. In the present case all assented to the doctrine that no man ought to be asked to work for less than a living wage." As to the fundamental truth of the doctrine probably most men agree. The difficulty is in fixing the amount which constitutes a proper minimum in any given case. Shall it be Joseph Chamberlain's "three acres and a cow," John Mitchell's "six rooms and a bath," or shall it be, as the Court decided in this case, the amount the men demand?

IN AN interesting contribution to this issue on milling practice at the mines of the Pittsburg-Silver Peak Company in Nevada, Mr. Henry Hanson calls attention to the maintenance of high stamp-duty while the speed was reduced from 105 to 96 drops per minute. This result Mr. Hanson ascribes to the opportunity afforded the ore particles to settle between blows so that effective crushing might be done. The point is worthy of consideration. In the Transvaal, however, relatively high speeds are the rule, and the tendency is to increase the weight of the stamps up to 1400 and even 1600 pounds, and a stamp-duty of less than 6 tons per diem would be considered low. So important is weight in the estimation of the Rand metallurgists that the wear of shoes is compensated by extra metal.

DISMISSAL of bankruptcy proceedings against Otto Heinze & Company will have a good effect. The methods of the Heinzes are too well known to need comment; they stand for that kind of financial freebooting which assumes the dignified title of Napoleonic. The Heinze plan is directly the opposite from the Lawsonian. There is no brass-band, no alluring discourse to draw a crowd and sell tickets for the show; a growing camp suddenly finds Mr. F. Augustus Heinze in its midst; his interests ramify; at every turn in the path comes the rattle of a lawsuit. When financial difficulties threatened the existence of the firm the multitudinous relations of Mr. Heinze brought trouble to a host of innocent miners. The solvency of the house is therefore welcome, in that it means return of confidence and influx of capital, re-invigorating many paralytic enterprises.

Transportation and Coal Mining.

The constitutionality of the so-called commodities clause of the Hepburn law has been passed upon by the Supreme Court of the United States. With fine impartiality the principle contended for by the Government is affirmed at the same time that the practices of the railways are approved. Theoretically the Government wins; actually the present railroad practices remain undisturbed. Yet the decision, in confirming the main contention of the Government that it is within the constitutional powers of Congress to provide for the separation of transportation and trading, opens the way to far-reaching legislation. It seems that Congress has power to regulate these matters, but in the first attempt has not hit the right means for doing so.

In connection with the coal business the necessity for legislation of this sort is keen. It will be remembered that for years anthracite mining was generally unprofitable. It was only after the business came under the control of a group of railroads working in close harmony, that the present satisfactory conditions were produced. It is difficult to regulate competition in the coal industry, and excessive competition has been the rule, except where regulation has come through railroads. It is easier to monopolize transportation than mining, because the larger amount of capital involved in a single working unit can be commanded by fewer people. The process of monopolization has advanced far in the anthracite region. In the bituminous fields it is less advanced. Under our anti-trust laws the coal companies are not allowed to combine for limiting production. The amount of coal available, and the ease with which it can be opened, is a constant temptation to new investment. Bituminous coal is used only as mined, and owing to seasonal variations and to the intimate relation of fuel to industry, the trade is a constantly fluctuating one. Excessive demand is followed by a glut of the market. It is also peculiarly expensive to let a coal mine lie idle. As a result of these circumstances an intense competition exists in most of the bituminous fields, and in practically all of them the mining capacity is far in excess of the average yearly demand—often indeed in excess of the maximum possible demand. Under such conditions the only possible regulation of the trade has been by the railroads, since the basis of profits in the coal business has been the ability to get a regular supply of cars and to have them withheld from competitors.

Another fact of large importance is the circumstance that the railroads are themselves large users of coal. As the largest consumers they have naturally demanded the lowest price, and as a means of getting favorable terms have either taken up mining directly, or have distributed their contracts among companies that were content to make practically all their profit from their commercial trade and to furnish coal to the railroad at a merely nominal profit in return for the assurance of a regular car-supply. In many States such profit as obtains in the coal business comes from that portion of the output which reaches the small consumer.

When the railroad itself undertakes to mine coal, either directly or by means of a subsidiary company, two motives are usually dominant. The first is the vital necessity of an adequate supply of fuel at the minimum price. Certainly no railway manager is warranted in buying coal if it can be mined with profit to his stockholders. Mining, however, eventually leads to selling coal because of the necessity of disposing of certain sizes or grades not wanted by the railroad. In the second place there is the ever-present demand for traffic, and all additional traffic either built up anew, or taken from competing roads, is, according to the law of increasing returns, of importance to the railway management even when the profit per ton carried is small. A railway manager

is always keen to induce the opening of mines and the shipping of coal because thereby a rich reward comes to his road. When Mr. E. H. Harriman took hold of the Chicago & Alton, that railway had but little coal traffic, despite the fact of its crossing excellent fields and serving a well populated territory. An active campaign resulted in the opening of many mines and a good traffic was created, partly by the simple process of taking it from other roads. Coal shipments are so important, ranging from 25 per cent of the total traffic of certain granger roads to above 80 per cent of that of coal roads, that mines may be and often are run at no profit, merely to furnish traffic to the railways. This results in cheap fuel at the industrial centres, but it robs a great industry of its independence and has an important influence in perpetuating bad business methods and increasing accidents. An operator who must keep running to meet interest on a note at bank will sell coal at any price, and will accept any terms from his men, in hopes of better times later.

It was to correct these and similar evils by absolutely divorcing transportation from mining and manufacturing, that the commodities clause was inserted in the Hepburn rate law. The anthracite carrying roads, it will be remembered, contested the law in the United States Circuit Court for the Eastern District of Pennsylvania and won, the law being held unconstitutional by Judge Gray with Judge Dallas concurring. It is on appeal from this case that the Supreme Court has just decided the law to be constitutional. As construed by the Court, however, the sole object of the clause is to prevent carriers from being associated in interest with the commodities transported at the time of transportation. The act only compels the railroads to dissociate themselves from the products they carry, and the Government's contention that the law applies to the ownership of stock and prohibits the transportation of commodities simply because they have been produced by the railroad company, is declared untenable. While the immediate effect is favorable to the railroads, and is good in that it does away with the necessity for a complete re-organization and untangling of the present complicated ownership of coal lands and roads, the decision none the less opens the way to remedial legislation. Monopoly of transportation can not be used to cure the evils of unregulated coal-production. There must be real separation of the production from transportation. The coal business must be made independent. When this is done the public will see the necessity for a regulated combination of interests and of production, but when the profits of one industry are credited to another the public is properly suspicious. Mr. John Mitchell is fundamentally right in saying that a higher average price for coal is vital, though that does not necessarily entail higher retail prices. Each great industry should be given the right to a legitimate profit, and no country can gain permanently by making so important a business as the mining and selling of coal unprofitable in itself and a mere mechanism for furnishing profitable traffic to railroads. In clearing the way to a perception of these fundamentals the opinion is of prime importance.

Regulating Copper Production.

Efforts to regulate the copper industry in America by consolidation are reported to be under way. The situation of the copper miners and smelters has been in some respects most unsatisfactory. The high prices which prevailed for a period aroused unwarranted hopes. This led to the opening of a host of new mines, and to enlargement of plant and equipment at the older properties, so that in the aggregate a potentiality far in excess of commercial requirements was created. Suspension of operations is always disastrous, not alone from the sacrifice of return on invested capital, but from deterioration of plant and injury to the mine. It means loss of money to shut down, and it also involves heavy continuing expenditure. A close association of the copper producers for mutual protection seems necessitated. The logic of circumstances points in that direction. Mr. W. E. Corey is now said to be engaged in forming a combination for this purpose. This would indicate the possibility of a cordial understanding with the United States Steel Corporation. Whether such community of interests would prove a general benefit is worthy of careful inquiry. The tactics of the Steel Corporation have been one of the serious causes of the continued financial uncertainty in this country. That corporation has been in a position to do for steel precisely what is needed for copper, namely, to fix the price for a definite period long enough to encourage a revival of construction, without which no utilization of the industrial equipment of the country, commensurate with its magnitude, is possible. The manufacturing capacity of the nation is necessarily in excess of mere maintenance of the machinery of civilization; it contemplates expansion. The productive capacity of the copper mines at the present time is also an expression of confidence in the determination of men to enlarge their activities. The opening of the new great mines of Nevada and Arizona in the dreary fog of a financial storm is evidence of inspiring faith. If this faith be not shared by the public, however, the results become detrimental. The burden of carrying great stocks of copper now rests heavily upon the shoulders of a group of capitalists. This is a condition which must cause the debit side of the copper-ledger to look unpleasant for a long time to come. The trouble has arisen largely from the uncertainty of the market, from the limitation of foresight; and the latter has been rendered the more difficult by the disturbing influence of the Steel Corporation. The independent steel producers are having a hard fight for their lives; the formation of a copper trust affiliated with the steel trust would drive the independent copper producer to bay and to ultimate surrender. To contemplate the extinction of competition in copper mining is not pleasant, but it would perhaps steady the commercial world and relieve tension. Industry in general would be promoted. There is no means for surveying the field and knowing the future requirements of trade except organization. It is a choice between a business run at haphazard with waste and loss, or regulated by economic methods.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

D'Arcy Weatherbe is at London.

W. E. Thorne is at Bahia, Brazil.

James Douglas has gone to London.

Ralph Baggaley is in San Francisco.

J. J. Abbott has been visiting California.

William A. Farish is in Sonora, Mexico.

W. R. Caithness is in Western Australia.

Edward H. Nutter sails for Alaska May 12.

Henry C. Beeler has been in Hailey, Idaho.

F. Danvers Power has left London for Australia.

J. H. Curle is at Jumlunder, in the Punjab, India.

A. R. Ledoux is in the Black Hills of South Dakota.

N. J. Welsh is at the Engineers' Club, at New York.

Brenton Symons has left London for Newfoundland.

E. F. Burchard is visiting the fluorspar district of Illinois.

Edgar Rickard will be at Chicago May 12, and New York May 16.

W. H. Corbould is manager for the Mt. Elliott Copper Co., Queensland.

H. W. Hardinge has returned to New York from Tucson and Denver.

G. H. Garrey is examining the Ojuela properties at Mapamí, Durango.

R. K. Clancy is operating the Santa Rosalía mine, in northern Sonora.

T. A. Rickard expects to be at Denver May 10, and at New York about May 22.

Charles Butters has returned from Nevada and expects soon to go to London.

Louis Janin, Jr., has recovered from a long illness and is now in San Francisco.

G. H. Hutton, superintendent of dredges near Council City, has returned to Alaska.

Henry Taylor is visiting the mines of the Tasmania G. M. Co. at Beaconsfield, Tasmania.

Frank M. Leland, president of the Empire Copper Co., Mackay, Idaho, is in San Francisco.

Godfrey Doveton has been in the American Hospital at Mexico City. He is reported better.

J. O. Armstrong is general manager for the Lloyd Copper Co., Ltd., at Burrago, New South Wales.

G. D. Reid, who has been examining copper properties in Idaho and Oregon, has returned to Denver.

James MacNaughton, general manager of the Calumet & Hecla, has returned to Calumet from a visit south.

W. Wraith, superintendent of the Washoe smelting plant, has been in San Francisco, on his return from Cananea.

J. B. Martin, manager for the American Mining & Development Co., at Camptonville, California, has been in San Francisco.

W. E. Simpson, formerly superintendent of the Zinc Corporation, Broken Hill, is adapting the Australian treatment of silver, lead, and zinc ores to the San Francisco del Oro, at Chihuahua, Mexico.

G. E. Farish, of Denver, Colorado, and Mexico City, left Denver on May 3, to examine some properties in southern Mexico. His address for the next three months will be 2nd Bucareli, No. 35, Mexico City, Mexico.

Obituary.

Ambrose H. Douglas died of pneumonia at the Leonesa mines, Matagalpa, Nicaragua, on May 1. Mr. Douglas was well known at Silver Peak, Rawhide, and other Nevada camps as a man of ability and of extraordinary regard for rectitude and honor.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, May 6.

Antimony	12—12¾c	Quicksilver (flask)	44—45
Electrolytic Copper	15¼—16½c	Spelter	6¼—7c
Pig Lead	4.45—5.40c	Tin	32—33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 29. £ s. d.	May 6. £ s. d.
Camp Bird	1 3 3	1 3 0
El Oro	1 4 4½	1 6 0
Esperanza	2 16 3	2 16 0
Dolores	1 5 0	1 10 0
Oroville Dredging	0 11 0	0 19 9
Mexico Mines	5 12 6	4 11 3
Tomboy	1 2 6	1 1 3

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 30	12.57	4.23	5.05	53
May 1	12.57	4.23	5.05	52¾
" 2	Sunday.	No market		
" 3	12 57	4.20	5.05	52⅞
" 4	12 57	4.20	5 05	53⅛
" 5	12.57	4.20	5.05	53⅞
" 6	12.57	4.20	5.05	53½

MINING QUOTATIONS—NEW YORK.

	Closing Prices. Apr. 22.	May 6.
Amalgamated Copper	78¼	—
American Smelting & Refining Co	89½	93¼
Boston Copper	11¾	—
Butte Coalition	24	26½
Cumberland-Ely	7⅝	7½
Dolores	5½	5
El Rayo	2⅝	2⅝
Giroux	8	7⅛
Greene-Cananea	10	10¾
Indiana Sonora	3¼	—
La Rose	6⅞	7
Miami Copper	14¾	15¼
Nevada Consolidated	20¾	20⅞
Newhouse	2⅞	2⅜
Nipissing	10⅜	10¼
Ohio Copper	6¼	6⅛
Tennessee Copper	41¼	42⅛
Utah Copper	45¾	49¼
Yukon	4¼	4⅛

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. May 6.		Closing Prices. May 6.
Adventure	9¼	Mass	14⅞
Ahmeek	155	Mohawk	63½
Allouez	42¼	North Butte	67
Arcadian	4¾	Old Dominion	54¼
Atlantic	10½	Osceola	136
Calumet & Arizona	103¼	Parrot	34¼
Calumet & Hecla	615	Santa Fe	2
Centennial	31⅞	Shannon	16¼
Copper Range	79⅞	Superior & Pittsburg	14⅝
Daly-West	9⅞	Tamarack	71
First National	5⅞	Trinity	14⅜
Franklin	15½	United Copper Con	12¾
Granby	100	Utah Con	41⅜
Greene-Cananea, ctf	10¾	Victoria	5¼
Isle Royale	27½	Winona	5⅜
La Salle	14¼	Wolverine	146

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, May 6.

Atlanta	$ 16	Midway	$ 25
Belmont	99	Montana Tonopah	83
Booth	20	Nevada Hills	1.45
Columbia Mtn	15	Ophir (Comstock)	1.50
Combination Fraction	97	Pittsburg Silver Peak	60
Daisy	37	Rawhide Coalition	35
Fairview Eagle	30	Rawhide Queen	35
Florence	3.25	Round Mountain	90
Goldfield Con	8.20	Sandstorm	15
Gold Kewenas	16	Silver Pick	21
Great Bend	15	St. Ives	10
Jim Butler	18	Tonopah Extension	65
Jumbo Extension	15	Tonopah of Nevada	7.00
MacNamara	25	Tramp Con	7
Mayflower	11	West End	31

General Mining News.

ALASKA.

A. L. Slow and 85 men have sailed from Seattle to open the Alaska Central railroad from Seward to Placer valley. The road, of which 55 miles are completed, has been out of commission, and in the hands of a receiver since November 1907. The finished portion of the road will be put in running order at once, and 20 miles of new road across Placer valley into Turnagain will be constructed. Five hundred men will be employed.——The Copper River & Northwestern railroad has completed its steel bridge across the Copper river at Flag point with a span 560 ft. long. The road will be open through Abercrombie canyon some time this month.——The Mt. Andrews Copper & Iron Mining Co., operating the Mt. Andrews mine situated on Prince of Wales island, in Ketchikan district, recently made a shipment of 2400 tons of ore to the smelter at Tacoma. This is a copper ore, running high in iron, being desirable as a flux to mix with the silicious ores from western Washington. The Mt. Andrews was formerly operated under lease by the Britannia Smelting & Refining Co. Sam Lichtenstadter is now manager of the property.

ARIZONA.

GRAHAM COUNTY.

Nathan L. Amster, president of the Shannon Copper Co., has been in Clifton conferring with J. W. Bennie about the construction of their designed railroad to be called the Shannon & Arizona. It will be 10 miles in length to connect the mine with the mill, and will be of standard gauge. The surveys have been made for this new road, which in addition to the saving in freight charges will give immunity from annual floods that now cause heavy damages. It is estimated to cost $400,000 and will save about $80,000 per annum.

MARICOPA COUNTY.

The Vulture Mines Co. took possession of the Vulture gold mines in Arizona in September 1908, and also took over the 80-stamp mill and 100-ton cyanide plant. In the mine development work required only unwatering and repairing of tracks. The first month was spent cleaning up. Since October 1 new development has been carried on with the utmost vigor, and more than 50 men are now at work. Large orebodies have been encountered on the 450-ft. level, and are being blocked out.

PIMA COUNTY.

The first report made by the Oxide Copper Co., operating near Silverbell, shows that 263,400 tons of ore were extracted, carrying 49,600 lb. copper, with a little silver. Frank Higgins is superintendent.——A. N. Jack, manager for the Arivaca Mine & Milling Co., states that work has been resumed at the mines and that living houses, blacksmith shops, and other necessary buildings are being erected. An adit is being driven, and has been advanced 150 ft. A drift on another part of the vein shows ore averaging $10 in gold and silver.

CALIFORNIA.

INYO COUNTY.

(Special Correspondence).—The April output of the Keane Wonder mill was approximately $28,000. The 100-ton cyanide plant has been in commission since March 15, and has nearly doubled the production. The new shaft is down 100 ft. and will be sunk to the 200-ft. level before any lateral work is commenced. At the present time the shaft is in the best ore yet found in the mine. A 25-hp. hoist will be installed on this shaft at once.——A 30-ft. vein, assaying in places $11 per ton, has been cut at a depth of 12 ft. in the Pennsylvania group, owned by the Barton Bros. The property is situated six miles southeast of the Keane Wonder.——Ten stamps are dropping at the Skidoo mill on ore running from $20 to $25 per ton. From 35 to 40 tons are being handled daily. The company is refusing to renew leases. It is expected to have 15 stamps in action before the end of May.——A large reserve of milling ore has been developed at the Cashier and a 5-stamp mill is being erected.——The Valley View, American Eagle, Contact, and several near-by properties are producing on a small scale.——Steady developments are under way at the Black Canyon, Red Rose, Southern Belle, and other local properties, but nothing of an important nature has recently developed.——The Tecopa Co. is considering the installation of a 4-furnace silver-lead smelter, with a capacity of 600 tons per day. The plant will be erected at Tecopa and a 15-mile railway line will be constructed from this point to the Gunsight and Noonday mines. It is understood that everything has been settled save the signing of the contracts by the president of the Tecopa Co. The company recently negotiated for the Needles smelter, but the deal fell through, owing, it is reported, to the refusal of the railroads to grant desired rates.

Bishop, May 1.

NEVADA COUNTY.

(Special Correspondence).—Ore milling from $30 to $50 per ton is being taken from a 14-in. vein at the Ben Franklin. The ore is treated at the Larkin mill.——The shaft at the Nichols mine is being unwatered and active work will soon commence.——The shaft at the Hill mine, in the heart of the residence district of Grass Valley, has been unwatered and driving on the vein is under way. The mine is under lease to a company of local miners.——Operations have been suspended at the Norambagua because of the bursting of the water-wheel. An order has been placed for a new wheel.——Forty stamps are dropping at the Idaho-Maryland mill. The 8-ft. vein of high-grade milling ore developed in the 500-ft. level has been intersected at the 600 and 700-ft. points, and shows equally good stuff. Several men have been added to the working force.——Work is being pushed on the Greek vein at the Union Hill mine. The working crew is being steadily increased. Clifford Graham is superintendent.——Thirty-six men are working at the Delhi and considerable development work is going on. Repairs to the mill have been completed and 20 stamps are in action. Hamilton Eddie is superintendent.——Operations have been resumed at the Greystone mine and a new adit has been started, which will tap the vein about 800 ft. from the portal. This will give backs of about 600 ft. George Hegarty is superintendent.——The Lecompton has been unwatered to below the 300-ft. level and it is expected to start the mill within 10 days.——Arrangements have been perfected for the extensive operation of the Cold Springs property. The adit will be pushed ahead in the hopes of striking the main channel. The channel now opened will be systematically worked. Harry B. Adsit has been appointed manager.——The Oustomah has been re-opened and the 10-stamp mill is crushing $20 ore from a 2-ft. vein between the 300 and 500-ft. levels. The shaft is being sunk steadily and has nearly reached the 1000-ft. level. At this point the vein is 2 ft. wide with 2 ft. more of mineralized matter carrying numerous small stringers of quartz. Frank M. Evans is superintendent. The mine is under bond to E. H. Wilson of Allegheny.

Grass Valley, May 3.

TUOLUMNE COUNTY.

The New Aurum Mining Co. is making good progress in the extensive work being done at its group of mines on Hunter creek southeast of Tuolumne. The track from the War Eagle to the mill has been completed and milling has begun. Ore is being extracted from the Hunter and War Eagle, and a big supply of it assures a long and steady run. It is intended to unwater the Hunter, which is 400 ft. deep, and carry on work in the several drifts. The War Eagle adit has reached a length of 200 ft.——A. Davidson, of Fresno county, and associates have resumed work at the Fay and Jewel mines, situated southeast of Tuolumne.——A 5-stamp mill is being erected at the Eureka mine, near Big Oak Flat.——Operations have been resumed at the group of mines near Tuolumne formerly worked by the United Mines Corporation. The property is under lease to the Erie Mining Co. The cyanide plant has been moved from the Dead

Horse claim to a site near the new mill, and other changes have also been made. The crew of men employed is being gradually increased and within a short time all parts of the property will be in operation.——One hundred tons of ore from the Santa Ysabel mine, which is being operated under lease by McGinn Bros., yielded $20 gold per ton. More ore is being taken out, and on a more extensive scale. ——Three veins ranging from 20 to 25 ft. in width and of good milling ore have been uncovered at a depth of about 200 ft. in the Gold Crater mine at Knight's creek. During the last four years the company has spent more than $100,000 on the property and done 2000 ft. of development work.

YUBA COUNTY.

The American Mining & Development Co., operating at Snowden Hill, 9 miles above Camptonville, is driving a bedrock adit to develop an old river channel. It is planned to run about 1½ miles of underground work. R. G. Mead, assistant general manager of the company, has recently been in San Francisco, where he purchased a two-drill compressor and two 2¼-in. drills from the Sullivan Machine Co. The compressor is to be belted to a water-wheel made by the Joshua Hendry Iron Works. A small electric light plant was also purchased.

COLORADO.

CLEAR CREEK COUNTY.

(Secial Correspondence).—The Sigafoos boring machine, which has been installed at the Georgetown adit on Columbia Mtn., was tried out for the first time with water this week. In four minutes 2 in. of ground were broken. The machine then broke down as in former demonstrations, owing to the fracture of a shaft. The test was witnessed by the graduating class of the State School of Mines at Golden. ——The 50-ton mill of the Terrible mine is now running steadily on ore from the lease operated by Wood & Co. on the fourteenth level. About 50 tons of lead-zinc ore from the Smuggler mine are also being handled each week. Shipments of smelting ore from the Terrible are being sent to the Georgetown sampler, and fetch returns averaging $90 to $100 per ton in silver and lead.——The shaft of the Smuggler mine is 375 ft. deep, and is being sunk a farther 150 ft., with levels at 75-ft. intervals. Machine drills are being brought into play to increase the speed of sinking.——The 25-ton mill of the Honest John Mining, Milling & Tunneling Co., up Chicago creek, is now running night and day on ore from the Black Eagle mine. The compressor recently installed at the collar of the shaft was pulled out last week and a larger one is being placed in position. It has been decided to sink the shaft another 150 ft., as the ore-shoots appear to continue downward. J. F. Puchert is manager.

Georgetown, April 30.

TELLER COUNTY.

A rich ore-shoot has been opened on the ninth level of the Modoc mine, between Bull hill and Battle Mtn. It does not exceed a foot in width, although most of the vein is 4 ft. between walls, yet is far more valuable than the full-sized vein. A 30-ton shipment has been sent out by the general manager, F. H. Frankenberg, to the smelter at Pueblo. The Modoc mine is operated both on company account and under the leasing system, but the new strike was made by miners in the employ of the company.——The permanent water-level in the Portland mine is less than 40 ft. above the 1500-ft. level. All of the orebodies on the 1500-ft. level will have been stoped out during this month. After that, all pumping will be stopped and the remaining ore taken out through raises to the level above. This will save the pumping expense that has averaged from $3000 to $3500 per month during the last year.——An electric tramway is being installed by the Cresson Consolidated Mining Co., to transport ore and waste from the shaft to the ore-house or dump.

IDAHO.

BONNER COUNTY.

There is much excitement in and near Clark Fork over a find of gold-bearing ore by Leroy H. Whitcomb, a merchant of that town, on Antelope Mtn., and many have staked out claims adjoining the ground on which the vein appears. Samples of ore show excellent gold assays.

IDAHO COUNTY.

Walter B. Pittock and James Coverly, one time owners of the Buster mine near Elk City, have brought out specimens of ore from the Snowstorm property which ranks with any yet seen from the district. The property is owned by the Pittock brothers and Coverly. They have one adit 210 ft. long on the 105-ft. level, running in ore which extends to the surface. They also have struck the vein in another adit on the 175-ft. level, from which the rich specimens were obtained. Six ounces of pulp panned out more than $6 in gold. There are from 4 to 8 in. of this material running through the centre of a vein from 3 to 5 ft. wide that is also quite rich.——Frank J. Marvin, of Spokane, and William F. Newton, of Goldfield, have bonded the June Bug group of 5 claims, near Elk City, for $30,000. Newton will remain on the property arranging the camp, and men will be put to work on development at once. A great amount of open cross-cutting has been done and the pay-shoot has been opened for more than 400 ft. Assays from $36 to $300 per ton have been obtained.——J. H. Shearer, of Buffalo, and his associates have bonded the Redfern placer ground, along the Salmon river, from G. H. Vessey for 60 days for $35,000. The property is known to be rich and comprises 270 acres, but, like the Moscow bar, at the headwaters of the North Fork of the Clearwater, it is placed high, and getting water to the gravel will be expensive. A long ditch is to be dug, and a gasoline pump will be installed the coming summer.

LEMHI COUNTY.

It is hoped that early in June the new smelter being installed by the Lemhi Smelting Co. at Nicholia will be blown-in on ore from the company's Lemhi Union mine. The smelter will have a capacity of 100 tons per day. Besides the Lemhi Union, the company owns another mine in the same vicinity, known as the Teddy & Elizabeth, where 20 men are now employed. D. E. Coughanour is manager for the company, and C. M. Stoley is superintendent.——There is a great deal of activity in the county, as the Oregon Short Line has crews working at both ends of its proposed line from Armstead, Montana, to Gilmore, in the southern part of the county. The rails will be laid this summer and a rich mining and agricultural country will be opened up.

OWYHEE COUNTY.

(Special Correspondence).—The Pauper mine on War Eagle Mtn., operated by R. H. Leonard, is producing some good ore, and in sufficient quantity to start up its mill which was recently built. From the Burro mine, in the same place, Inglis & Nettie are taking out ore which shows free gold, and sending it to their mill just above Silver City.——The Silver City Mining Co. is waiting for the snow to melt before installing electric power for running its compressor. A cross-cut adit is being run 2200 ft. long to cut a vein. The machinery arrived too late last fall to permit being set up at that time.——The Banner Mining & Milling Co. is still driving its mill level or Erdman cross-cut to reach the main vein at a depth of about 700 ft. There have now been driven 1060 ft., and 300 ft. still remain to be done. Waugh drills have been used, and have made the fastest time in the district. During advance several veins have been intersected, one of which has 6 ft. of good milling ore and a narrow streak on the foot-wall of high-grade material. As soon as the main vein is reached development will be started on all the veins. A mill has already been built containing Nissen stamps, Johnston vanners, and Wilfleys, followed by Callow tanks and pan amalgamation. Peter Steele is general manager, and J. F. Inglis is superintendent.

Silver City, May 1.

SHOSHONE COUNTY.

The Northern Light Mining Co. of Wallace will develop a property on Pine creek which has already been extensively developed. In the bottom of a 16-ft. shaft from 12 to 15 in. of solid galena ore has been exposed, and two short drifts were driven, which have also made a good showing. Machinery will be installed and extensive development will be started at once.

KANSAS.

CHEROKEE COUNTY.

(Special Correspondence).—Preparations are being made for increased production in the Galena camp. The Clermont Co. south of the city is planning the early erection of a large mill to treat the ores opened up last year. This company owns in fee 294 acres and holds under lease more than 200 acres more. Thorough testing of the ground was made last year, resulting in the discovery of large ore deposits both at shallow and deep levels. One run of ore was found at 160 ft., while a better one showed at 250 ft. A shaft is down 170 ft. and has penetrated the first run.——What is proving to be one of the most extensive mines in the Kansas field is being developed by A. O. Ihlseng on the Robertson and Ping tracts. A large new 400-ton mill is to be built, half on one lease and half on the other. The dirt from each lease will be treated separately in the mill. The ground has been extensively tested and found to be mineralized to the 300-ft. level. This will be one of the deepest mines in the district.

MICHIGAN.

F. G. Coggin has resigned the superintendency of the Atlantic stamp-mill at Redridge and will be succeeded by W. E. Carpenter, at present master mechanic of both the



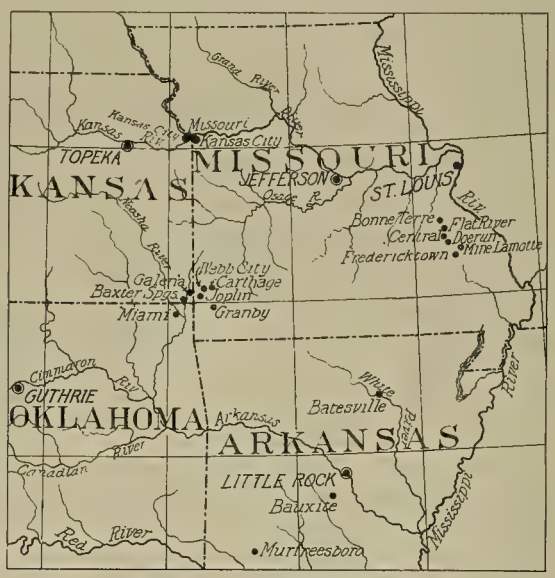
Shipping Ingots From Copper Range.

Baltic and Atlantic mills. Edward Koepel, superintendent of the Trimountain mill, will also take charge of the Baltic and Champion mills, all three belonging to the Copper Range Consolidated Co.——Though occasional patches of poor ground are encountered, the lower levels in the Trimountain mine continue in fairly well mineralized ground, the general average of which is undeniably a big improvement over that opened during the past years. The company has 53 machine drills at work, and is sending about 1000 tons of 'rock' to the mills daily.——The Beaver dam, near No. 5 shaft of the Tamarack mine, which had been rising rapidly for two weeks, broke through its banks recently and sent a flood of muddy water into the shaft. It was found necessary to suspend operations at the mine till the flood subsided. But little damage was done, and the shut-down was quite short.——Connections have been effected between the No. 1 and 2 shafts of the Hancock mine. Henceforth nearly all the ore developed near No. 1 will be hoisted through No. 2, which is a 5-compartment vertical shaft, and one of the largest in the Lake Superior district. At present it is 1800 ft. deep, and should cut the main Hancock lode with about 400 ft. farther sinking.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—An era of mill building has begun in the Missouri-Kansas district. In the Prosperity and Duenweg camps several mills have just been completed. The Highland mill of 400 tons has been built to replace the one destroyed by fire last fall. East of this the Lincoln Mining Co. has finished a new plant and has installed Richards pulsator jigs, which are a new feature in this field. On an adjoining lease the Wolfsheart Co. is erecting a mill on a lease which was well tested and developed last year. There are a number of other companies which have rebuilt their plants and moved mills from other parts of the district.——Following the unexpected strike of zinc ore in the bed of Spring river east of Carthage some weeks ago, the mining fever has taken possession of many of the land owners in the vicinity, and hundreds of acres have been leased for mining purposes. A good strike has just been made on Dr. L. C. Carter's land, where the drill entered ore at 90 ft. and continued to 205 ft. Another hole has been started.——The Continental mine in the Porto Rico camp has resumed operations after a two months' shut-down during which repairs were made. This mine has put mules in the drifts to haul the cars of ore from the face to the shaft in order to increase the capacity of the mine.——A new tailing mill is being built on the lease of the Prairie



The Missouri-Kansas Zinc Belt.

Chicken Mining Co., near the site where the old mine has been in constant operation for many years. Vast tailing piles have accumulated, and these have from time to time been removed for ballast for the railroads, but never before treated in a mill. There is still a large pile ready to be treated which contains a good percentage of zinc.——A new 150-ton mill has just been completed on the Degraff brothers lease west of Joplin. The mill was the former Alice of Old Vincennes in the Chitwood camp, but has been re-built and new machinery added. The ore here is of the disseminated type and special machinery has been installed for its treatment. The mine has been developed to the 180-ft. level, where a face of ore 20 ft. high is being worked which runs from 10 to 12% zinc. Two shafts are down and a tramway carries the ore from the north shaft to the mill.——The Little Jew mine southwest of Joplin has been revived and is again in the producing list. It was closed down during the low ore prices. A new company has undertaken its development and has sunk a new shaft.

Joplin, May 1.

MONTANA.

JEFFERSON COUNTY.

Arrangements have been made to resume operations in the property of the Brooklyn Bridge Mining & Milling Co., at the head of Lump gulch, about six miles from Clancey. The company owns 15 claims, of which three are patented; a 150-hp. boiler and Lidgerwood hoist good for 1000 ft., and a Davis calix drill. Two thousand feet of development work, half of which is in shafts, have been completed, the

deepest shaft being 435 ft. The rest of the work is in drifts.

MISSOULA COUNTY.

F. D. Willard, secretary of the Saltese Consolidated Mining Co., operating a group of claims near Saltese, has announced that a 20-ton reduction plant will be installed in June. J. E. Mason Bennett, formerly of Pueblo, Colorado, will have charge of the plant. The main adit has encountered a blind vein 3 ft. wide and assaying 14% copper across the entire width. The miners then drifted 90 ft. on the vein and the ore was found to improve. The adit has been run 350 ft. beyond the blind vein, and it is hoped to reach the main vein in less than 100 feet.

SILVER BOW COUNTY.

Counsel for the Deer Lodge farmers have submitted an offer to arbitrate with a view to securing damages from the Anaconda and Washoe companies, or in lieu of that to dispose of their lands to them. The proposition of the farmers is to arbitrate the question of damages, and if the awards are not satisfactory to the company they will submit their lands for condemnation under the law providing for the condemnation of lands for public use.——The Corbin Copper Co. has cut a new vein in the Dewey adit, assaying 5% copper. Five other adits are being driven for veins. F. Richards says the property is in condition to ship ore if the company so wished.

NEVADA.

ESMERALDA COUNTY.

E. Hampton has resigned as mine superintendent of the Goldfield Consolidated Mines Co., and his place will be taken by H. P. Henderson of the company's staff. Henderson is a graduate of Harvard, and for some time was superintendent of the Belmont mine at Tonopah.——An official report has been issued by the Goldfield Consolidated, stating that for the first quarter of the present year the earnings of the company were $1,905,245, the expenses $306,480, and the net profits $1,598,764. The ore output for the quarter was 46,119 tons, of which 45,747 tons were milled and 352 tons shipped. The average costs per ton were $3.70 for mining, $2.53 for milling at both mills, and $0.16 for transportation, making a total average cost of $6.346 per ton. The cost of operation has steadily decreased. After paying dividend No. 3, on April 30, 1909, the company had on hand in cash and liquid assets more than one million dollars.——E. Stuart, State Mining Inspector of Nevada, has appointed Ed. Ryan of Goldfield as his deputy.——The *Goldfield News* states that the Lucky Boy and Mountain King group, at Lucky Boy, has been optioned by J. H. Miller to a representative of the U. S. S. & R. Co. for a million and a half.

NYE COUNTY.

Thomas G. Lockhart, president of the Goldfield Florence Mines Co., has purchased a group of placer claims from J. W. Riggle for $10,000. The claims are considered among the richest in the Manhattan dry placer section, and lie between the Big Six and Happy Hooligan claims. A lease on one of the claims secured by Mr. Lockhart has been panning ground running $40 per cu. yd. Other Goldfield people are acquiring placer locations in Manhattan and are arranging for extensive operations.——In the Tonopah Mining Co.'s property the stopes on the Mizpah, Valley View, and Silver Top veins continue to yield the regular tonnage. Sinking continues in the Mizpah and Red Plume shafts, and the latter is within 28 ft. of the desired depth before lateral work is taken up and prospecting begun. The bottom of the shaft shows a broken formation of no economic value. The mill report for the week shows that an average of 93 of the 100 stamps were dropping constantly, crushing 3020 tons of ore, with an average value of $21.50 per ton.——Between 35 and 40 men are engaged in completing the mill of the Jefferson Gold Mining Co. at Round Mountain. James McDonald, the superintendent, has the building finished, and it only remains to fix the rest of the machinery.

STOREY COUNTY.

The weekly report from the Comstock mines and Sutro tunnel shows that a considerable amount of re-timbering and repairing has been carried out. At the Ward shaft sinking is being continued, and the total depth reached is 2549 ft. Two sinking pumps have been lowered into position. In the Ophir work is being done on the 2000, 2100, 2200, and 2300-ft. levels, and shipments have been made of 312 tons to the Kinkead mill and 54 tons to the Butters plant.——No work was done in the Gould & Curry, Savage, Hale & Norcross, Chollar, and Potosi mines during the week. The Yellow Jacket mine extracted 210 tons from the 1200-ft. level, and milled altogether 933 tons, most of it coming from the dump.

WHITE PINE COUNTY.

The contract for carpenter work and machinery erection in the fourth unit of the Steptoe concentrator has been awarded to the Hughes Construction Co. of Denver. The time allowed for completion is 90 days, after which the machinery must be put through a satisfactory run of seven days before the unit will be accepted by the company. Experience having demonstrated that the Steptoe concentrator is somewhat deficient in Wilfley table capacity, the management has conceived the idea of double-decking the Wilfley floor and thereby gaining room for nearly twice the number of tables at first employed. The second deck of Wilfleys is now in operation in two of the three units of the mill, and the results are said to be highly satisfactory.

OREGON.

BAKER COUNTY.

The Cougar mine at Granite has been idle for the last six years. In consequence of the examination by Theodore L. Lammers, of Spokane, on behalf of the National Mining & Leasing Co., the mine is to be reopened and operated on lease till June 1910. Some 2000 ft. of development work has been completed in the underground workings, and ore-shoots over 200 ft. in length have been opened, the vein in places being from 15 to 17 ft. wide. Equipment on the surface includes a crushing and cyanide plant, which are now undergoing alterations and repairs.

LINCOLN COUNTY.

Plans for a mill and a third adit 200 ft. below No. 2 adit are being made by the Gold Success Mining Co., which owns 12 claims near Elk City. Charles E. Skiles, of Denver, is president of the company, and D. S. Cowgill, of Spokane, secretary and treasurer. J. Y. Smith, the manager, announces that more than $25,000 worth of ore is already blocked out, and that it is expected to install a 10-stamp mill before next fall. One hundred and forty feet have been run on No. 2 adit since September 1908, making a total length of 440 ft. from the portal.

UTAH.

BEAVER COUNTY.

The Horn Silver Mining Co., in the San Francisco district, has issued its annual report for 1908. It shows that during the year the company did 1477 ft. of deadwork consisting of raises, drifts, and winzes. On the 500-ft. level and extending down to the 600-ft. level considerable silver-lead ore has been developed that should produce a fair tonnage. The zinc ores remain practically undisturbed. On account of the low price of spelter a market could not be found for this class of ore. Prospecting is now going on on the 100, 500, 600, and 700-ft. levels in a new territory. The profits of the company for the year were $3333. The average value of ore shipped was $9.44 per ton. M. C. Morris is general manager.

SALT LAKE COUNTY.

A large force of men is installing machinery in the Ohio Copper Co. reduction plant at the mouth of the Mascotte tunnel. Not all of the equipment has been delivered and Colin MacIntosh, the general manager, says that it will require from three to four months' time to have the first section completed. This first section will have a capacity of 2250 tons of ore per day.——A large force of men has arrived at the Highland Boy smelter to commence the work of tearing down the structure. All the steel will be shipped

to Tooele, where the International smelter is now under way. The Highland Boy smelter employed over 1000 men, and treated about 800 tons per day, producing 99% blister copper. Owing to trouble with the agricultural interests in the Salt Lake valley a court decree enjoined the company from smelting ores carrying more than 10% sulphur, and from sending out arsenical fumes. The farmers at first demanded $300,000 for permission to allow the smelter to run, which was refused, and in January 1908 the plant was closed down.

TOOELE COUNTY.

The Western Utah Copper Co.'s mine in the Deep Creek district is to be developed on a comprehensive scale by Duncan McVichie. The mine is about 100 miles from a railroad, and was closed down late in 1907. On the 80-ft. level is an orebody 85 ft. wide, which is of the same width on the 150-ft. level. The company claims to have over 100,000 tons of 5% copper ore blocked out.

UINTA COUNTY.

George H. Mulvey, superintendent of the Pittsburg & Salt Lake Oil Co., will operate the gilsonite mines of that company at Vernal in a different manner to that previously adopted. The hydro-carbons give off a dust that is highly flammable, and caused a bad explosion in February 1908 when blasting in the Dragon mine. It has now been found that blasting can be superseded by the use of steam-points, which effectually cut out the material without any danger.

WASHINGTON.

FERRY COUNTY.

The Lone Pine ground of the Pearl Consolidated group, from the lower adit level to the surface, has been leased to a former superintendent and a stockholder, representing the majority interests, for one year. The lessees of the Surprise ground, belonging to the same group, are shipping a carload, and sometimes two, of ore per week.

A fine body of ore has been found on the 300-ft. level of the Lucille Dreyfus mine. The property is now in good shape for breaking ore, and a contract has been let for a 500-ton shipment to the Spokane & British Columbia railway, for transit to the Granby smelter.

LEWIS COUNTY.

The Mayfield district, situated 20 miles southeast of Chehalis, is attracting considerable interest. Over 100 men are now on the ground prospecting and exploring, and about 20 outfits are engaged in sinking shafts, driving adits, and making open-cuts. The most conspicuous of these is the Consolidated Gold & Copper Co. of Seattle, at the head of which is W. H. Springfield. The district covers an area of about 15 square miles in the well-settled farming section of Cowlitz valley. The ore consists of basalt, carrying free gold, assays of which run from $2 to $60 per ton. Ore of this character outcrops and is said to be richer as depth is gained, the deepest workings not being more than 60 ft. All the ground being prospected is owned by farmers whose titles do not give them the mineral rights. This tract of country was granted by the Government to a railroad company some years ago, the mineral rights having been reserved by the Government. The present owners obtained their titles from the railroad company, which could grant only surface rights. The farmers are said to be co-operating with the miners in having the country prospected.

OKANOGAN COUNTY.

The Molson Gold Mining Co., in Myers Creek district, has installed in its mill six Nissen gravity stamps and plates with self-feeders for handling the ore. Each stamp weighs 1300 lb. and has a drop of 7 in. The mortar blocks stand on massive concrete foundations. In addition the mill is equipped with two latest pattern Wilfley concentrating tables.——The Oroville Consolidated Mining Co. has a vein on the Blue Bell claim, which adjoins the Gold Dust property, 50 ft. wide at the surface and carrying copper. Ore taken from an open-cut on the same vein shows free gold. This vein is being well explored.

STEVENS COUNTY.

(Special Correspondence).—In Chewelah district the Chewelah Copper Mining & Smelting Co. is about to establish a reduction plant, to be built in two units of 50 tons capacity, at an estimated cost of $25,000. The company will purchase custom ores.——In the Metaline district, the Oriole company has a car of ore sacked awaiting shipment. A shaft will be sunk on the vein and continued to a depth of 450 ft. The ore as broken will be shipped probably to the Panhandle smelter at Sandpoint, Idaho. A hoist and blower have been purchased and will be installed at the shaft.——The main vein on the Blue Jim mine assays about $60 in gold, silver, and copper and ranges from 4 to 10 ft. in width. In the cross-cut adit, at a depth of 80 ft., a 4-ft. vein has been cut, but the value has not been given out.——The No. 6 furnace of the Northport smelter has been run recently on First Thought and Le Roi ore, flue dust and bricks from the roast beds, to make a general clean-up.——Henry Garrett, owner of the Longstreet mine, on the Columbia river in the Enterprise mining district, near Hunters, reports that he has struck a vein at a depth of 90 ft. which assays $62 in gold and silver. The ore contains also an average of 8% antimony.

CANADA.

ONTARIO.

There were seven mills in operation around Cobalt during the past year. They are the Buffalo, Cobalt Central, Coniagas, King Edward, McKinley-Darragh, Northern Customs Concentrator, and the Nipissing Reduction Co. Concentration is carried out in the ratio of 40 or 45 to 1 for the product of all the big mines. Four companies have mills under construction. The price for cobalt gradually went down in 1908 till at the end of the year it was almost unmarketable. The Anglo-French Nickel Co., of Swansea, Wales, paid 36c. per pound for 8 to 10% cobalt, and 55c. for ore running 16% or more. After April the prices went down again and now the Canadian Copper Co. and the Deloro Mining Reduction Co. offer practically the only market for cobalt, and they will only accept it when it runs 6% and the nickel contents are lower than the cobalt contents. No smelters now pay for arsenic or nickel.

MEXICO.

JALISCO.

E. R. Haggin, of Los Angeles, has become representative for an Anglo-French syndicate which intends operating the Mina Grande in the Hostotipaquillo district. Last year a deal for a controlling interest in the Mina Grande was made with the Dwight Furness Co., of Guanajuato, which owned the property, by Luis Chevrillon, of Mexico City. The Mina Grande is an *antigua* with a long record of former production.——The San Rafael mine in the Parnaso camp, is now being worked under an option from H. H. Sawyer, of Guadalajara, by J. B. Murray and George H. Watt, who have interested Scottish capital. Sawyer was formerly connected with the San Rafael mine, while Watt came from Guanajuato.

MEXICO.

The El Oro Mining & Railway Co. reports for March: Mill No. 1 ran 31 days, mill No. 2 ran 30 days, crushed 26,631 tons of ore, yielding bullion $214,740; working expenses, $118,490; expenditure on development, $23,121; total, $141,611; profit, $73,129; profit on railway, $4000; total profit, $77,129; expenditure on permanent improvements, $1000.

OAXACA.

G. N. Grigsby and E. L. Spurck have taken up 22,000 acres of land for the Mexican Agricultural Land Co., on much of which are placer deposits which they consider valuable. The property of the company is 45 miles southwest of Tierra Blanca, on the Veracruz & Pacific railway.

SONORA.

The Lucky Tiger mine is under option to a New York and London syndicate until July 21 for a sum said to be ₱7,000,000. Thomas H. Leggett and Frederick Hellmann are now engaged in examining the property. C. W. Mitchell, engineer for the company, says that the company completed 10,000 ft. of development in 1908, and is doing 1000 ft., a month in drifts, cross-cuts, raises, and winzes. There are about 350 men employed in the mine and mill.

Special Correspondence.

MEXICO.

Enlarging Chihuahua Smelter.—Encinillas Smelting Co. — Conchos River Placers.—Palmilla Tunnel Completed.—Pedro Alvarado.

Enrique C. Creel, governor of Chihuahua, is doing everything in his power to induce the American Smelting & Refining Co. to increase the capacity of its smelting plant at Morse. It is a strong point with the governor to make Chihuahua an important mining and smelting centre, and he expresses the hope of eventually seeing 15 furnaces in blast at the Chihuahua plant. Such a number is, of course, quite out of the question, being in excess of any A. S. & R. Co.'s plant, even in more important mining centres than Chihuahua may ever expect to become. Many single camps in the United States produce a greater tonnage than the entire State of Chihuahua. But it is known that plans have been drawn for increasing the present 3-furnace Chihuahua plant to 5 or 6 furnaces, and the same are now under consideration at the New York offices of the company. As such changes would mean material additions to the power-plant, buildings, and track-system, it would be close to the end of the present year before they could be completed, even if decided upon. The company is putting in aerial tramways to its Santa Eulalia mines. The one to Mina Vieja is completed, and it is understood that a branch will be run to the Santo Domingo mine also, in order to sufficiently increase the output from these properties to supply the needs of the El Paso smelting works as well as those of the Chihuahua plant for these desirable silver-lead ores. It is understood that the little Santa Rosalía plant of the Encinillas Smelting Co., Ltd., has been shut down for some time after a rather short and not very successful run, but it cannot be learned whether the closure is to be of long or short duration, nor whether the trouble is due to lack of ore, metallurgical problems, shortage of water(which has been worrying the company for some time), or to financial difficulties. The mining interests throughout Chihuahua continue slowly to improve. The Republica Mining Co., in western Chihuahua, has its mine and mill in such condition as to enable it from now on to pay a 1% per month dividend. Joseph S. and Charles Qualey, whose excellent property in the Yoquivo district has been recently mentioned in these letters, are preparing to prospect with a churn-drill the placer grounds of the Dale Bros., of Chihuahua, and John R. Roslyn, of New York. These adjoin the Santo Domingo placers on the Conchos river in eastern Chihuahua, and, if the ground proves as claimed, dredges will be erected for working the placers on a large scale. The Qualeys have also put things in shape for a resumption of operations on their Parcionera mine in Santa Eulalia.

In the Parral district the Palmilla tunnel has been completed on that property, being 343 metres long by 3 high and 2½ wide. It will make a saving of 133 m. in the lift of the water from the mine. That should soon pay the cost of the tunnel, and it is expected that a spur may be run over from the Parral & Durango railroad to the mouth of the tunnel, and thus do away with the aerial tram. The Palmilla is under a 15-year lease to Boston people, and it is understood that the owner, the once famed Pedro Alvarado, has sold this property, which has yielded him several millions, for $200,000. That amount will scarcely pay his debts, so that he bids fair to become soon again a simple ordinary miner, or a mine-boss, working for day pay. At the Tecolotes mill (in Santa Barbara), of the American Smelters Securities Co., 800 tons per day are being treated, and by a combined, direct re-crushing, classification, and fine concentration, excellent results are being obtained, and the mill is working up to practically full time, at least over 98%. For the 35,000 to 40,000 tons of zinc middling that has been produced it is stated that appropriation has been made by the company for the installation of a zinc separator.

The famous old copper mine, La Mina Cobriza, now called El Tesoro, situated nearly 30 miles from Mazatlán, at Villa Union, is under option to English capitalists for a large sum. The mass of copper ore exposed is 5000 ft. long., and from 400 to 1200 ft. wide. It is said to average 4% copper and to contain 0.5 dwt. gold and 4 oz. silver per ton. In the early days great quantities of *magistral,* roasted copper-iron sulphide, were here produced for use in the patio process.

H. S. Denny, of the firm of Denny Brothers, mining engineers and metallurgists, of Mexico City, London, and South Africa, is a firm believer in the possibilities of Mexico as a mining country. In speaking of the mining industry in the Republic of Mexico and its future possibilities, Mr. Denny said through the *Mexican Herald:* "The average mine in this country is really no more than a prospect possessing practically no development, and it would appear that the general policy has been to pay attention to and to ship only high-grade ore. This work has been carried on, in a majority of cases, regardless of the principles of scientific mining development and in most cases such work is to the detriment of the mine and the owner.

"In considering the possibilities of the mining industry in the Republic of Mexico, I can say only that I am surprised with the results thus far obtained. Whether we judge the country from the standpoint of area of mineral distribution or from the variety of minerals to be found, or from the richness of the ore deposits, or from the natural working facilities, Mexico can claim equality with any mining country of the world, and for a combination of all these factors there is surely no other that can approach it. When compared with South Africa and Australia, I find that the great lack here is capital to carry out the enterprises offered."

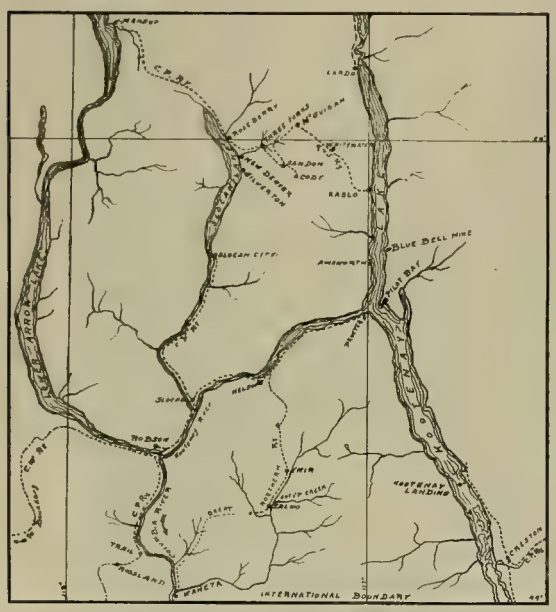
In many respects the greatest event in the history of Mazatlán and the State of Sinaloa was the completion of the Southern Pacific railway to that point on April 18. Governor Cañedo arrived from Culiacán in a special train of four coaches. On the train were the superintendent, Ingram, the chief engineer, and a large number of distinguished persons from Culiacán and Guaymas. At the conclusion of a banquet the committee escorted the governor to the spot where the last rail-joint waited the driving of the golden spike.

SLOCAN, BRITISH COLUMBIA.

Standard. — Vancouver. —Richmond-Eureka. — Ruth. — Rambler-Cariboo.—Lucky Jim —Whitewater.

Among the mines of Slocan district the most prominent at present are the Standard and the Vancouver, of the Van-Roi group, in Silverton camp; the Richmond-Eureka, Hidden Treasure (the latter of the Slocan Star group), and Ruth, near Sandon; the Rambler-Cariboo Co. mine in McGuigan basin; the Lucky Jim, near Bear lake; and the Whitewater group, in Whitewater camp, which, as well as the Lucky Jim, is in the eastern part of the Slocan district. The Standard and the adjoining Emily Edith, on Four-Mile creek, Slocan lake, are being worked conjointly by G. H. Aylard, of New Denver, B. C., and John A. Finch, of Spokane, Washington. The former is in charge of operations. The Emily Edith group of mineral claims was formerly owned by the Emily Edith Mines, Ltd., of London. It has been opened by six adits, which, together with other underground work, have a total footage of about 9000 ft. The aggregate tonnage of ore shipped is not yet large, but a considerable quantity of concentrating ore is available. The Standard had been opened by four or five adits, and the mine has been energetically worked during the last two or three years. Its output last year consisted of about 1250 tons of first-class ore shipped to the smelter, and a similar quantity of milling ore placed on the dumps. The metal contents of the first-class ore were 106,000 oz. silver and more than 1,600,000 lb. of lead. The milling ore will, it is estimated, concentrate 4 to 1 and contain much zinc. The Vancouver group, a lease and option to purchase which were last summer transferred to the Van-Roi Mining Co., Ltd. (an offshoot of the Le Roi No. 2, Ltd.), of London, is

being actively developed under the direction of Paul S. Couldrey, manager of the Le Roi No. 2 mines at Rossland, B. C. Last year's shipments consisted of about 500 tons of lead concentrate and picked ore, containing 72,000 oz. silver and 594,000 lb. of lead, and 1038 tons of zinc concentrate averaging 45% zinc and 42 oz. silver per ton. The first half of a 12 by 18 D 2 Rand air-compressor, which at that elevation will run about three large piston-drills, has been installed. It is driven by water-power, a flume and pipe-line 4000 ft. in length conveying the necessary water. It is intended to erect a concentrating mill near the mine, and for this a site has been graded and cribbed. The Richmond-Eureka group is owned by the Consolidated Mining & Smelting Co. of Canada, Ltd., with head office in British Columbia at Trail. W. H. Aldrich is managing director of the company, and A. W. Davis, of Sandon, local superintendent of the Richmond-Eureka mine. The vein opened on one claim of this group passed through a part of the Hidden Treasure claim of the Byron N. White Co.'s Slocan Star group, and thence into another claim of the Richmond-Eureka group. About 2900 tons of silver-lead ore of good grade were shipped last year from the Richmond-Eureka



Slocan District, British Columbia.

and some 500 tons from the Hidden Treasure. This year's shipments from the former at the end of April amount to 1300 to 1400 tons. Operations on the Hidden Treasure are in the charge of Oscar V. White, of Sandon, resident superintendent for the Byron N. White Co. The chief interests in this company are held in Spokane, Washington, and Milwaukee, Wisconsin. The Ruth Mines, Ltd., is an English company, having as managing director and local manager, George Alexander, of Kaslo. The Ruth group comprises 14 mineral claims. The mine is opened by five tunnels and the underground development aggregates nearly 15,000 ft. The vein is opened to a vertical depth of 600 ft. The ore, which occurs in lenses and irregular bodies, is hand-picked, and that which is not of good enough grade for shipment is concentrated. It yields two products, silver-lead and zinc concentrates. The former averages 65% lead and 85 oz. silver per ton. The zinc concentrate as it leaves the mill averages about 36% zinc, 1.5 lead, 14 iron, and 12 oz. silver per ton. At the Kootenay Ore Co.'s sampling works, at Kaslo, it is passed through Dings electro-magnetic separators and raised to a 50% zinc content. In 1908 the Ruth shipped 750 tons of hard ore and carbonates and 1257 tons of zinc concentrate. The Rambler-Cariboo output last year, about 1200 tons, was not large, owing to low prices of silver and lead. This year a production of about 100 tons per month is being maintained. The ore averages about 116 oz. silver per ton, 46% lead, and 12 zinc. A deep-level tunnel, 4500 ft. in length, is at its face 1450 ft. below the lowest outcrop of the vein, and 2400 ft. below the apex outcrop on the summit of the mountain into which it has been driven. This drains the mine and admits of exploration below the level of the old workings. Last year two new orebodies were found, the deepest being on the 1050-ft. level. W. E. Zwicky, of Kaslo, B. C., is manager. The controlling stock interest in the Rambler-Cariboo Mines, Ltd., is held in Spokane, Washington, where the company's head office is situated. The Lucky Jim, which in recent years has not been operated, is to be worked under lease. It is situated on the Kaslo & Slocan railroad between Kaslo and Sandon. The lessees are Hemenway & Loper. G. W. Loper has lately been making arrangements at Kaslo for the shipment of ore by steamer down Kootenay lake to a point on the Great Northern railway between Nelson and Spokane, Washington. The Lucky Jim vein was discovered in 1892, and was worked irregularly for silver-lead for several years. During the years 1896-99 about 5600 tons of concentrating ore was produced, and from this was sorted out 1600 tons of zinc-blende averaging 50% zinc, 3% lead, and 6 oz. silver per ton. After having been idle several years the mine was re-opened in 1903 by George W. Hughes, its present owner, and worked for three years, during which time about 6000 tons of zinc-blende averaging 54% zinc was mined. The collection of duty on zinc ore entering the United States resulted in stopping operations in 1906. It is stated that the zinc zone has been passed through in the mine, and a body of silver-lead ore entered, which later promises a considerable tonnage of ore of shipping grade. The Whitewater and the Whitewater Deep have been for about two years worked under lease by S. S. Fowler, of Riondel, W. E. Koch, of Nelson, and John L. Retallack, of Kaslo, all of whom have long been actively associated with mining in the district. Mr. Retallack is in charge as manager. Production in 1908 amounted to about 30,000 tons of ore mined and milled, and shipments were 2300 tons of silver-lead concentrate averaging 120 oz. silver per ton and 45% lead, and about 8000 tons of zinc running 40 to 45% zinc with 20 oz. silver per ton. A new company, named the Deep Mine, Ltd., has been incorporated and has taken over part of the property. This company is also managed by Mr. Retallack. It is driving a 1500-ft. tunnel to develop the property.

BUTTE, MONTANA.

Smoke Damage.—Corbin Copper.—Tuolumne.—Pittsburg-Montana.—East Butte.—April Production.—Parrot.

The final complaint of the farmers of the Deer Lodge valley concerning smelter fume has been disposed of. Judge Hunt asked them to show by what means the smelter fumes can be reduced; the smelter officers have claimed that everything known to science had been done. The farmers claimed that the company had not sincerely tried to abolish the smoke nuisance. They presented a plea to Judge Hunt affirming that they could not secure the services of expert witnesses "except under very unsatisfactory assurances." They proposed that the whole question of damages be submitted to arbitration, and if the board should find unfavorably to the Amalgamated Co. that the company be required to condemn the land owned by the farmers. The attorneys for the Amalgamated Co. objected, claiming that the matter of damages had been passed on by both the master in chancery and by Judge Hunt, both of whom had decided against the farmers. Judge Hunt took the matter under advisement. Two experts representing the Federal Government have been making tests at the Washoe smelter with a view to determine whether or not the objectionable substance in the smoke could be converted profitably into sulphuric acid and fertilizer. They are being given every assistance by the Washoe officials. The latter have always contended that it would be impracticable to manufacture sulphuric acid, as the smelter could turn out 2400 tons per day, which is more than the entire world uses. To manu-

facture fertilizer it would be necessary to haul phosphates several hundred miles to the smelter, and the product would soon glut the market, there being little demand for the fertilizer in the West. To turn the sulphuric acid into the streams would cause more damage than to let the poison disseminate in the atmosphere. A former government expert suggested a pipe-line to the Pacific ocean, but this was shown to be impracticable. The case was dismissed.

The Corbin Copper Co., which is developing a group of 30 claims in the Wickes district, has cut the main lead in three places. Last week the Dewey tunnel cut the lead and found 25 ft. of ore, some of which assays 5% copper. Drifting is now being done on the vein. A good lead has also been cut in the Kathleen tunnel. The property is in condition now to yield ore for regular shipment, but no mining will be done for some time yet. The Tuolumne Copper M. Co. has just installed its new hoisting engine, a Nordberg first-motion, capable of working to a depth of 3000 ft. A new 20-drill compressor and additional boilers have also been erected. The company is now sinking a sump below the 1400-ft. point in the shaft, and when this is completed will cut stations at the 1400 and 1200-ft. levels, preparatory to cross-cutting to the vein south of the shaft. There is good ore in the veins at 1000 ft., but not sufficient in quantity. There are three veins that apex in Tuolumne group. The middle vein is the extension of the Edith May of the North Butte Co., and is the first vein south of the shaft.

In the consolidation of the East Butte Copper Mining Co. and the Pittsburg & Montana Copper Co., an important copper-producing company is formed. The East Butte Co., according to a call for the special meeting which is to be held May 11, will increase its capital stock from 300,000 shares to 600,000 shares of the par value of $10 per share, the increase to be used in taking up $2,500,000 in Pittsburg & Montana bonds and about 83% of that company's stock, on which the East Butte directors have secured an option. Three of the Pittsburg company's directors will be added to the board of the East Butte Co., and Oscar Rohn, who as superintendent has brought the Pittsburg company to a profit-earning basis, will remain in charge of the operations of that company.

April copper production by the Butte companies aggregated 25,347,420 lb., the mines averaging about 28 working days in the month. Not so much decrease in the month's output as had been anticipated. The ore tonnage was reduced, a higher grade being shipped to the smelters, but the curtailment of the copper production was not more than two million pounds.

Companies.	Output, lb.
Boston & Montana	7,350,000
Anaconda	6,451,200
Butte & Boston	1,128,960
Washoe	905,240
Parrot	649,600
Trenton	718,620
North Butte	3,339,000
Butte Coalition	2,912,000
Original	1,064,000
Pittsburg & Montana	604,800
Miscellaneous	224,000
Totals	25,347,420

The total average daily production was 905,265 lb., and there were 353,640 tons of ore mined during the month.

The Parrot Mining Co. is developing the Parrot vein on two levels, known as the 1900 and 2000-ft. levels, and on both the results are increasingly satisfactory; ore running 3 to 4% in copper having been found. At the Little Mina the company is engaged in cross-cutting for the vein. The stockholders of the Butte-Balaklava Co. have been invited to subscribe to a new issue of treasury stock at $10 per share. The cost of copper made by the North Butte Mining Co. is around 8½ cents per pound, according to one of the officials of that company. It is also asserted that the mine is in as good condition as at any time, and that developments on the new levels are satisfactory.

WASHINGTON.

Progress with the Tariff.—Reservoir Sites.—Irrigation.

Although a determined effort is being made to pass the tariff bill as framed in the Senate and presented by N. W. Aldrich, senator from Rhode Island, strong opposition has arisen to a number of important schedules, including all those relating to the mineral industry, and as the bill is being read in committee of the whole, all these paragraphs are being laid aside at the suggestion of certain senators until the undisputed paragraphs in the bill are disposed of. The senators who requested that the items go over are busy preparing amendments which will be more satisfactory to their constituents. There will be amendments to the iron-ore schedule, oil, zinc and lead ores, and coal. In compliance with an act passed March 3, 1909, which authorizes the Secretary of the Interior to reserve all lands within the Flathead Indian Reservation of Montana valuable chiefly for reservoir sites, and to report to Congress such reservations, Mr. Ballinger has sent a communication describing the lands within the reservation which have been reserved for the purposes mentioned.

Simon Guggenheim, senator from Colorado, has presented a bill which seeks to encourage irrigation. It provides that any citizen who shall sink a well so as to secure a flow of water adequate to irrigate at least 10 acres of land on any quarter section of any of the public lands of the United States within the States of California, Colorado, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, Washington, and Wyoming and the Territories of Arizona and New Mexico, shall be entitled to a patent for the whole of the quarter section. C. B. Slemp, of Big Stone Gap, Virginia, representative in Congress, has introduced a bill which provides that $2,000,000 of the money that would otherwise become a part of the reclamation fund be used for the drainage of certain lands in Virginia. The American Physical Society, composed of the foremost instructors of the leading universities of the United States and scientists prominent in the government service were the guests of the Washington Philosophical Society this week. A feature of the session was a lecture by Professor Max Planck, of Berlin University, on 'Mechanics as the Foundation for Physics.'

LONDON.

Exposition of Cornish Mining —Metallurgical Instruction in London and at Sheffield.—West Australian Mining Costs.

Visitors to London this summer will have the opportunity of studying Cornish mining at the White City, or Imperial International Exhibition, at Shepherds Bush. Last year at the same exhibition there were many mineral exhibits showing the resources of the English Colonies, but they were scattered and not particularly useful or interesting to the mining man. This year the Cornish exhibit will be ecpecially attractive. It is being organized by George T. Holloway, R. Arthur Thomas, of Dolcoath, J. J. Beringer, principal of the Camborne School of Mines, J. B. Cornish, secretary of the Geological Society of Cornwall, and many others of similar standing. For president of the section, Lord Falmouth has been chosen. Lord Clifton, Mr. Basset, and Mr. Pendarves have been elected vice-presidents. The exhibition will include almost everything dealing with the history and present position of the tin and china-clay industries, and with such a strong backing is sure to be exceptionally complete.

The evolution of the Imperial College of Science and Technology at South Kensington, which swallowed up the Royal School of Mines, at least in organization if not in name, is proceeding steadily if slowly. The latest arrangement is in connection for advanced studies in the metallurgy of iron and steel. It has always been felt that the provision of special laboratories and works at South Kensington for the study of this branch of metallurgy would be a mistake. Sheffield University already has as perfect a steel course of study as could be evolved, and it is desirable to specialize in London on non-ferrous ores. An admirable

arrangement has just been made whereby the metallurgical department at Sheffield will be affiliated with the Imperial College so that such students as desire to study iron and steel may take the special courses at Sheffield. The plan is for the two colleges to exchange facilities for study. Similar arrangements are said to be contemplated in connection with the iron and other metal courses at Birmingham and with the coal mining courses at Birmingham or Newcastle-on-Tyne. It is too early to give details at present. The steel course at Sheffield under the direction of Professor J. O. Arnold has won a very high reputation.

The reports issued by the West Australian mining companies are models of their kind and are therefore always worth close study. If every gold mining company provided such details it would be all the better for business. I specially say gold mining companies, because we can hardly expect companies producing copper and other metals, the markets and prices for which vary, to furnish the same details. The report of the Ivanhoe for 1908 has just been published. One of the most interesting items disclosed is that the working costs have now practically arrived at a minimum, being 17s. 8d. per ton of 2000 lb., as compared with 17s. 10d. during 1907. It is possible that but for a strike of firewood cutters in July, which caused the closing down of the mine and mill for a week, the average costs over the year might have been even slightly lower. In 1904 the costs were 21s. 3d. and during the next two years they were reduced to 19s. 5d. and 18s. 10d. respectively. These working costs include only mining, reduction, and general expenditure at the mine, and not mine development, London expenses, or taxes. Including mine development and all other West Australian expenditure, the costs at the mine came to 20s. 10d. per ton during 1908, as compared with 22s. in 1907 and 24s. 2d. in 1906. The average grade of the ore has been gradually decreasing, the yield having been 43s. 11d. in 1908, 45s. 4d. in 1907, and 50s. 3d. in 1906. It will thus be seen that the average profit has not been greatly reduced, having been 23s. 3d. per ton in 1908, 23s. 6d. in 1907 and 26s. 1d. in 1906. During 1908 the ore crushed in the 100-stamp mill was 227,898 tons, and the yield from the mill and cyanide plant was 117,743 fine ounces realizing £502,294. The total output since the commencement in autumn of 1897 has been 1,193,302 fine ounces valued at £5,086,339, and the total dividends paid have amounted to £2,230,000. For the last five years the dividends have been regularly £240,000 per annum. Ore reserves continue to be developed and the figures at December 31 last were 934,089 tons with an average content of 49s. 8d. These at the present rate of extraction should yield 43s. per ton, which is not much less than the yield for 1908. These reserves amount to rather over four years' supply, and developments have been such that the available tonnage has remained practically constant for several years.

SALT LAKE, UTAH.

Floods in the Desert.—Tintic Smelter.—Boston Con. Mill.—Mason Valley Smelter.—Cactus.—Silver King Coalition.

Melting snows have raised the level of the lake to such an extent as to cause uneasiness at the Garfield smelter. The Western Pacific tracks were under water, and except for the fortunate interposition of cold weather serious flood conditions would prevail.

The Tintic Smelting Co. is running with one copper and three lead furnaces in blast. Since October 29 over 6000 tons of bullion have been shipped by this company. The engineers of the Cole-Ryan syndicate, however, failed to recommend the purchase of the plant.



Garfield Smelter, Utah.

At the Boston Con. mill there has been some trouble with breaking of cam-shafts. The difficulty is believed to have been due to the steel in the shafts being too highly carbonized. The trouble has been remedied. New shafts put in seven months ago have run without a break. The battery superstructure in the mill originally rested on centre jack-posts, and additional braces have now been put in, making the construction rigid. The Nissen stamps are giving high duty, and have vindicated the choice of this method of crushing, made by A. J. Bettles, the superintendent of mills. The Utah Stock & Mining Exchange is about to move into new quarters in the Atlas block.

The Mason Valley smelting plant at Mason City, Nev., is not to be built at present. Some of the larger interests in the company object to building at a time when less than 1,000,000 tons of 4% copper ore is available. The surveying for the smelter-site has been completed, but no excavation work will be ordered until at least double the present tonnage is in sight. Of the authorized capitalization of 1,000,000 shares, 770,000 has been issued. George E. Gunn, general manager, is authority for the statement that a portion of the remaining 230,000 shares will be issued and sold to provide money needed to build the smelter. The plant is to do custom work for the Yerington district.

Since the closing down of the Cactus mine at Newhouse

little has been done toward overhauling the plant. A small force of men are at work underground prospecting. The higher-grade bodies of copper ore in this property have practically been exhausted. Until a better ore is found the prospects of resuming operations are not favorable. The company has outstanding obligations said to aggregate $200,000. Samuel Newhouse has pledged himself personally for most of this indebtedness, and unless large bodies of commercial ores are soon found, the indications are that Mr. Newhouse will again have to raise money for the company. He is now in New York. Plans for the reorganization of the company, with the addition of the Fink Smelting Co., are said to be under consideration. The experimental Fink smelting plant has been giving a good account of itself for more than a week past. The loss now is less than 1%, but the cost of treatment is such that the device is not as yet practicable.

Since the entry of the International Smelting & Refining Co. into Utah, many rumors are afloat regarding properties to be acquired. In addition to invading the Tintic district, it is said that overtures have been made to them for the purchase of F. Augustus Heinze's holdings in the Silver King Coalition Mines Co. Thomas F. Cole has inspected the Coalition properties and knows something of the deposits. The Coalition company refused to allow Heinze to transfer his smelting contract to the International, but it is thought that if the International purchases Heinze's interest the Coalition company will consent to the transfer of the contract. It is understood modifications of this contract have been agreed on. Should this arrangement be perfected it will put an end to the long dispute between the Coalition and Heinze, and give that company an opportunity to double its present output.

Arrangements are to be completed for the sinking of a 2-compartment shaft at the Prince Consolidated properties in Pioche. When operations were first inaugurated at this property a slope was driven parallel to the vein. This is now 600 ft. deep. As the vein has straightened up, the shaft at the bottom is more than 200 ft. from the vein. The long drifts on the lower levels are expensive and the arrangement for handling the ore is interfering with development and ore extraction. The new shaft is to be sunk 1000 feet.

JOHANNESBURG, TRANSVAAL.

Company Meetings. — Rand Mines, Ltd.—East Rand Proprietary.— Ore Reserves. — Diamonds in German Southwestern Africa.

For the majority of Rand mining companies, the financial year coincides with the calendar year. Numerous meetings annually occur in March and many reports are now, therefore, available. There are few engineers who have the leisure to wade through the reports in search of technical data. Broadly reviewed, the most satisfactory feature is the tone of cheerfulness and optimism consistently maintained. So many companies have been able to boast of bigger profits and improved efficiency that the chairmen of those concerns which have not done well have generally succeeded in presenting a hopeful outlook by reference to the success of their neighbors. At the meeting of the Rand Mines, Ltd., L. Reyersbach gave his usual review of the field's industrial progress, but the great improvement in the financial and technical position enabled him to speak "with more pleasure and confidence" than at any former period. The company's profit for 1908 totaled £1,010,830. Of this £853,079 was distributed to shareholders, bringing the dividend total to £4,092,815. Of the total revenue for the year (£1,047,088) £904,592 represented dividends from the 9 chief subsidiaries and from 3 other companies in which it holds large interests. Six of the company's subsidiaries increased their dividend rates during the year. Another meeting of great importance was that of the East Rand Proprietary. This has been the first ordinary meeting held since the amalgamation, which resulted in the unification of the group of mines formerly controlled by the company. During the last 6 months of the year, the company milled 856,320 tons with a profit of £591,744. The yield per ton was 30s. 7.3d. per ton and the costs 16s. 9d. The technical records of the company show that the ore reserves have been greatly increased during the year. It is satisfactory to find, indeed, that the majority of Rand mining companies have been fully alive to the necessity of increased development to satisfy requirements of extended milling equipments. Summarizing the position of a few of the mines, whose meetings have been held lately, the following statement may be compiled:

Company.	Annual milling capacity, tons.	Payable ore developed, tons.
East Rand Prop.	1,700,000	6,347,430
Ferreira	300,000	1,317,565
Simmer Deep	540,000	747,000
New Kleinfontein	460,000	1,053,600
Robinson	520,000	4,644,000
Village Deep	430,000	1,949,267
New Primrose	237,000	475,900
Ginsberg	144,000	473,000

With one exception the ore reserves are estimated over assumed stoping widths. The Simmer Deep calculates on milling tons. The position of the Robinson is exceptional. Obviously it would not be good policy in the Central Rand to develop so far ahead of the mill and incur expenditure on which no return could be expected for several years. But the Robinson reserves include 1,856,000 tons of Main Reef (valued at 4.75 dwt. over a stoping width of 90 in.), which have been developed by the drifts originally intended to serve only the Main Reef leader. This enormous tonnage has thus been added to payable ore reserves without new expenditure, owing to the reduction of working costs (now 11s. 6d. per ton milled) and the consequent lowering of the limit of payability. For the Rand Mines, Ltd.'s nine producing subsidiaries, with an aggregate milling capacity of 3,250,000 tons per annum, the ore reserves amount to 10,700,000 tons.

At the meeting of the Voorspoed Diamond Mining Co. held last week, the chairman stated that the German Government had taken control of the diamond output from German Southwestern Africa and that nothing would be done to disturb the market by overproduction. Official estimates at one time ran up to an output of 5000 carats per day. Dr. Merensky and M. E. Frames visited Damaraland recently and have since discussed the origin and capabilities of the diamond field before the Geological Society of South Africa. The district is situated near Luederitz bay and presents a billowy surface, mostly sand-covered. It is practically rainless. The diamonds are won from the sand and are nearly all of small size, though a few weighing 3 and 4 carats have been found. The average value is about $7.50 per carat. There is only a thickness of about 4 in. to the diamantiferous layer of sand, and it is estimated that only one-fifth of a carat is found per square yard. Dr. Merensky estimates that the total yield of the productive area can only be about 1½ million carats—an amount reckoned in Germany to be the annual yield for an indefinite period. The origin of the stones is a controversial matter. The two most widely accepted theories were (a) that the stones weathered out in the neighborhood of their present locality either from kimberlite, the older rocks, or amygdaloidal diabase; (b) that the diamonds were either transported from the interior by rivers or carried up from the south by the wind, or that the sea has washed them ashore in more recent times. Dr. Merensky and Mr. Frames, however, are unwilling to accept either view and consider that the diamonds were deposited contemporaneously with the sediments of the Cretaceous beds occurring thereabouts, which have been disintegrated and subject to natural concentration in the sandy valleys. They state that the typical kimberlite minerals have been proved to be absent. A few days after this paper was read a report reached Johannesburg that true yellow and 'blue ground'—the peridotite of Kimberley—had been struck by sinking 40 to 50 ft., and that, although no wash had yet been obtained, the familiar garnets, 'carbons' (ilmenite), and mica were present.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Mullock is a West Australian term for waste rock.

Bridge members built up of structural steel have approximately half the strength of the component metal.

Magnesite sells in San Francisco at $6 per ton. It is used by paper-makers and manufacturers of mineral water.

Petroleum from the Caddo, Louisiana, field runs 21.3 to 41° B. It is mostly a black heavy oil with a paraffine base, and contains as much as 1% of asphalt.

Allowance for impact stresses is made in designing bridges, but where electric motors in place of reciprocating engines are used these stresses are small.

High volatile content in coal reduces the relative heating capacity, which is the same as saying that the calorific power increases with the amount of fixed carbon present, the percentage of other constituents remaining unaltered.

Coal of 1.3 sp. gr. weighs 81.25 lb. per cu. ft., and a square mile of it, 1 ft. thick, contains 1,132,544 short tons. From this 25 to 50% must be deducted for waste in mining, and in addition whatever is indicated by the presence of faulting.

Under the doctrine of appropriation of water, he who is first in time is first in right, and as long as he continues to apply the water to a beneficial use, subsequent appropriators cannot deprive him of the rights his appropriation gives by diminishing the quantity or deteriorating the quality.

Shrinkage stoping is a term used in Western Australia for working stopes filled with broken ore. The term shrinkage refers to the fact that it is necessary to draw off about one third of the ore broken in order to give working room. The term 'filled stopes' is reserved for those into which waste rock has been run.

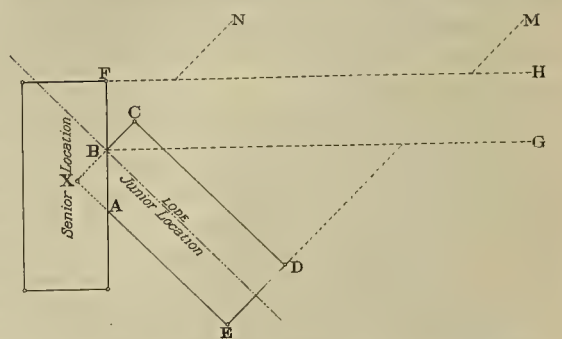
Scheelite is a common accompaniment of tin ores in Cornwall, England. It is usually associated also with copper in the same lodes, and tourmaline is generally present. This is also a combination frequently found in this country. While one may not be justified in the search for a certain metal when its ordinary accompaniments are discovered, it is always well to keep on the lookout for it. Tungsten-bearing metals with tourmaline have been found in many places in the granitic areas of the desert region of southern California.

Slickens is a term applied to slime of the kind which packs and will form a bottom in a running stream that will resist scour. The term slime has lost its original significance, which was practically that of 'slicken', or, more properly, particles of comminuted rock or ore in which one axis was extremely small in comparison with the other dimensional axes. In modern parlance 'slime' has superseded 'fine', and means only finely comminuted ore. Hence 'slicken' is useful as a term. Slickens are usually highly argillaceous, sericitic, or talcose slimes.

Silver may be detected when present in so minute a quantity as 0.01 mg. in solution. The re-agents used are 20 gm. salicylic acid slightly over-neutralized with ammonia, diluted to 1 litre, and a solution containing 50 gm. ammonium persulphate per litre. To the solution suspected of containing silver is added 20 c.c. of the salicylate solution, followed by 20 c.c. of the persulphate solution. An intense brown coloration is produced in the cold. It should be noted that this is evidently a catalytic action, as the same coloration is produced by boiling the solutions when silver is not present.

Magistral is not necessarily bluestone or copper sulphate. In the patio process time is counted upon to make up for defective materials, and in the early days the copper ores were merely given an imperfect roast, ground in arrastres or in Chilean mills, and mixed with *lama* or slime for addition to the pulverized ore in the *torta*. The sulphate of copper was thus mainly produced from the partly oxidized sulphides by further reactions in the *torta* or cake, that being the name given to the mass of pulverized ore which, like a thick mud, was spread out approximately 18 in. thick in the patio. Mines which produced copper ore suitable for making this desirable material were often called by the name *magistral*, which at once indicates its character.

The junior location with an end line A B C, as shown in the accompanying cut, is a valid location, though there is grave question whether a location with a broken end line, like this, would confer extra-lateral rights. The proper way to lay out the boundaries of the junior claim would be to extend B C to X and establish this as one of the corners of the claim. This course is authorized by the U. S. Supreme



Court in the Del Monte case. The junior locator would not, of course, acquire any surface rights to the triangle A B X. The extra-lateral rights of the senior location, assuming that the lode is the discovery vein, would be determined by the perpendicular planes B G and F H. The junior location would be entitled to all of the vein on its dip between the perpendicular plane D M and C N, after subtracting the extra-lateral rights of the senior location.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Designing Mine Equipment.

The Editor:

Sir—During the ten years I have been connected with the Arthur Koppel Co. I have had the opportunity of meeting the most prominent men in the mining industry, both in the United States and abroad, and of noticing their differences in methods of ordering machinery. In America, when a mine is in need of machinery, generally the chief engineer and the superintendent meet to discuss the matter. They usually decide that the machinery must be installed in the shortest possible time. At a second meeting, the superintendent calls attention to some practical points which should be taken into consideration. The engineering force then goes to work, and after a few weeks the plans are ready. Several blue-prints are made and inquiries sent out to manufacturers.

Not quite a year ago, while traveling in Europe, I took occasion to call on an old friend, well known in mining circles. He had just received a couple of hundred steel mining cars from one of our European branches, and had dictated a letter to our manager expressing his satisfaction. I asked him if the cars were of his own design, and he said in a kind of reproachful tone, "No, old boy, I gave up designing machinery myself long ago. It is not my business, and you fellows are in better shape to do it than I. Of course, I suggested certain changes, but as a whole the design is yours." In fact, abroad, the chief engineer or superintendent seldom designs any machinery. Generally when new equipment has to be installed, they write to the manufacturers, telling them their needs, explaining in detail the purposes of the new equipment, and in what way it will have to be used or operated. Which plan is the better is open to difference of opinion, but I personally believe it is better to leave the general designing to the maker of the machines.

A manufacturer receiving a drawing from a buyer has to make his figures exactly as per this drawing; very often where an improvement could be made, he refrains from making suggestions because he does not want to offend the chief engineer who designed the equipment. Furthermore, the factory can not be made responsible for failure if the work has been executed in accordance with the drawings and specifications. I know of one case where a suggestion was made looking toward improvement, and the engineer said he knew all about his business and did not want anybody to tell him how to construct machinery. The construction proposed by the engineer may involve certain steel bars bent in such a way as to make the labor unnecessarily expensive. This the manufacturer only can judge. The engineer of the mining company may have designed a special casting, when the manufacturer has similar patterns in stock which could be substituted. Now, if he has to stick to the plan of the engineer of the mine, he must naturally consider the cost of the new patterns. He finally might have a certain kind of material more suitable than the one specified, or he could use a certain size of steel bar he has in stock without making it necessary to wait for the delivery. There are many similar points which could be enumerated.

In the case of mine-cars, for example, the specialist who is designing practically nothing but cars constantly improves each part. He has information about all the inventions and improvements in his special line, and must naturally know more about it than the chief engineer of a mine, who only orders steel cars once a year or so. When the mining engineer designs the cars, the mining company loses time, spends more money than necessary, and takes the risk of receiving something antiquated.

I certainly believe that the mining engineer or superintendent who asks the representative of a manufacturing firm to make suggestions about the machinery he wants to buy, and who gives him all the details as to his needs, but asks him to make up the design, saves by doing so, and the chances are that he will finally receive a more perfect piece of machinery than he himself could design.

After the first sketch has been received the mine manager will be able to judge whether or not the manufacturer is the right man to deal with. The design submitted must absolutely cover the needs of the consumer; if it does not, the representative did not understand the needs of the mine, and where such a representative is sent by a manufacturing concern, the chief engineer of the mine is entitled to conclude that he could not do business satisfactorily with the particular manufacturer. A few corrections will always have to be made to meet the individual conditions of the mine. I have seen money spent in similar cases which could have been easily saved, if instead of proceeding on the assumption of 'knowing all about it', the specialist had been consulted.

P. SCHIBER.

San Francisco, April 5.

Mining in Siberia.

The Editor:

Sir: The article on 'Mining in Siberia', in the MINING AND SCIENTIFIC PRESS of February 13, recalls the years 1903, '04, and '05, which I spent in the region adjacent to Vladivostok and in eastern Manchuria. The mine on Askold island he mentions was discovered some thirteen years ago, through pieces of float being picked up when the present lighthouse was being built. The Chinese had worked the gulches for placer gold below the present mine for some time previous. The contractors for the lighthouse, O. W. Lindholm & Co., took interest in the rich float and located along the outcrop of what was then supposed to be a large and exceptionally rich vein. Shortly after they had started open-cutting in the decomposed outcrop they were offered for their holdings a large sum by a French company, but Lindholm, who had been in Grass Valley, California, about

1860, and had seen a real quartz mine, refused to sell. The present mill was ordered, consisting of five 350-lb. stamps and two Johnston concentrators. A Californian was sent out to set up and run the mill, and the property did well from the start. This was about 1900, and the mill was the first one in eastern Siberia, and, as far as I know, is the only stamp-mill there now. Shortly after this a 5-ft. Bryan mill was bought, but by the time the soft top of the vein was well worked out and its real size acknowledged, the problem of getting out ore enough to feed both mills was too much to handle. The Bryan mill was moved over to the mainland, near Nahodka bay, a part of America bay, which is about 100 miles north of Vladivostok.

After a year or two, during which the mill was operated in the open season, the cost of good American supervision, the inefficient local labor, and the peculiar Russian laws, made a change necessary. A contract was therefore made with some Chinese, whereby they mined the ore for half the bullion, the mill being only run during the warm months. As far as I know, the same plan is in operation now. The mill produced from two to five poods of gold per season, and the Chinese laborers probably stole much rich ore. However, despite all the leakage, the property has been a good investment for the owners.

I was in the employ of this company for about two years, and was principally engaged on the mainland in prospecting and developing several gold claims, and, during the war, some coal lands near Vladivostok. I did not have much to do with Askold till the summer of 1904, when I made two trips there. The vein is a small one, from 1 in. to 1 ft. wide, but exceptionally persistent for about 1000 ft., and at that time had been worked to about 500 ft. below the apex. The dip is practically vertical and the walls are granitic. The vein had numerous spurs and branches, but the main vein could always be followed. It always carried gold, generally most where it was narrowest. At the bottom of the workings the ore carried a large percentage of iron and copper pyrite and less free gold than above. Some of the ore was exceptionally rich, and it all averaged well. I have seen some beautiful specimens, but the Chinese probably saw many more. The method of work had always been to run a series of tunnels, one about 10 or 15 ft. above the other, which, from the Chinese point of view, was quite satisfactory. I tried to introduce a better system, but it only lasted while I was there to watch it.

Owing to the ignorant and careless Russian employees, the milling was very bad. I did fairly well with the mill when I was there, but the improvement was only temporary, and I had more important work elsewhere. The concentrate from most of the upper workings was rich, and amenable to cyanide treatment, but I had no opportunity of doing anything with it except in the laboratory. The method of letting the concentrate oxidize, and then re-milling, saved over half the gold content, but in the end it slimed so that a good portion was lost. From what I have heard, the mine was not doing so well last year.

At Nahodka bay I operated the Bryan mill for a time on a small vein that paid well. I also opened up several promising quartz prospects. I examined quite a number of various prospects farther up the coast, as far as 100 miles north of Olga bay. On the Chuchiga river, above Olga bay, is a silver-lead prospect owned in Vladivostok that was formerly worked by Chinese and Koreans. Calamine is also found with the ore. A. Bordeaux examined the property. Near Olga bay is coal and some good magnetic iron, but how extensive the deposit is I do not know.

The coast country is an ideal one to be in—clear rivers, good hills, abundance of game and trout, timber, and plenty of Chinese farmers to rely upon for supplies and animals. From what I saw of the country, it has considerable undeveloped mineral wealth. Nearly all the streams have been worked for placer gold by the natives in former times, especially in the vicinity of America bay. Trees growing in the old pits were from 150 to 200 years old. All over northern China, Manchuria, Korea, and eastern Siberia there are similar workings, and these are fairly safe guides. The placers are generally exhausted, and no veins were worked except they contained good quantities of gold. Personally, I have a strong belief in Siberia for mining, especially where Chinese can be used as labor, as they are hard to beat when one understands them. The most of the working class that I had to do with were a worthless lot. However, I was there in a strenuous time and had principally to deal with convicts.

F. L. Cole.

Tientsin, China, March 16.

Unwatering an Old Mine.

The Editor:

Sir—I am studying the problem of unwatering a mine on the Mother Lode which has been shut down since 1882. The 300, 100, and 1500-ft. shafts are full of water and are caved near the surface. They are 4 by 9 ft. When the mine was running the water was baled by a skip from the 1500 to 1000-ft. level, and flowed along this for 740 ft. to the 1000-ft. shaft, up which it was raised by a Cornish pump. The shafts are inclines with a pitch of 70 degrees. The 1500-ft. shaft has a pent-house at the 900-ft. level, and also has several bends.

Electric power is available (11,000 volts, alternating, three-phase) at a cost of $5 monthly. The mine is eight miles from the railroad. Freight from San Francisco is $8 per ton.

No records are available as to the flow of water or to the amount of water in the mine. A former foreman guessed the flow at 25 gal. per minute. Another hint as to the amount of water is given by the time it took the mine to fill up, namely, two years. Unfortunately, there are no maps of the underground workings. It is known that levels were run every hundred feet below the 500, down to the 1000-ft., and extensive stoping was done. There are no levels below the 1000.

There is no machinery on the mine, and the problem is: What kind of machinery to be put on for the purpose of unwatering the mine. Shall I use electric pumps, and a hoist to handle them? Or shall I bale the mine out with a hoist and tanks? Can the air-

lift be profitably used? I am told that electric sinking-pumps are troublesome.

If any of your readers have been doing similar work lately, a record of their experience would be gratefully accepted, and I feel sure would be of interest to many of your readers. I should be glad to have advice on the proper method of doing this work.

I find the following estimate in my notes:

Estimate of Cost of Unwatering a 1500-ft. Shaft in Guanajuato, 1905.

By Baling:	
60-hp. electric hoist	$ 4,000
Freight	250
60 hp. for 6 months	2,250
1500 ft. ¾-in. wire rope	500
Erection	500
Pay roll for 6 months	3,000
Two water tanks	500
General expenses	1,500
	$12,500
By Pumping:	
50-hp. electric pump	$ 3,100
Duplicate parts	500
30-hp. hoist	1,500
1500 ft. 5-in. pipe	2,000
Erection	500
Freight	250
80 hp. for 6 months	3,000
Pay roll for 6 months	3,000
General expenses	1,500
	$15,350

PROBLEM.

San Francisco, April 28.

Uses of Aluminum.

The Editor:

Sir—In a recent issue of the MINING AND SCIENTIFIC PRESS, Bertram Hunt has a communication on the possibilities of aluminum as a precipitatnt in cyanide work, especially where the solution contains base metals, such as copper. About a year ago I made a few experiments with aluminum, the solution having been used in the treatment of an ore containing 7 lb. of copper per ton. By precipitating the lime from the solution, and making it alkaline with caustic soda, it was found possible to regenerate 2 lb. of cyanide for each pound of copper in solution, as Mr. Hunt says can be done, but the cost was quite prohibitive. I have not the notes at hand, but think it figured at 80c. per lb. of KCy, at the price of aluminum then obtaining. Electricity, and even zinc-shaving precipitation, gave so much better results, provided the solution was rightly handled, that the aluminum experiments were given up.

There is little literature on the subject of aluminum precipitation. I remember a chapter in Gage's book and, I think, one in Dr. Scheidel's, and I find a stray note or two in my scrap-book, but all seem unfavorable to its adoption. The necessity of using caustic soda in the place of lime is a great objection. Nevertheless, in a process that is developing so rapidly as cyanidation, it is quite unsafe to predict, and Mr. Hunt and other workers would do well to experiment further. It is granted that both zinc and electricity present difficulties, and now that aluminum promises to become relatively cheap, it is certainly worth investigating.

EDMUND SHAW.

Kirkland, Arizona, April 23.

Cyanidation in Guanajuato.

The Editor:

Sir: In an article entitled 'Cyanidation of Parral Silver Ores', appearing in your issue of April 3, H. T. Willis gives a tabulation of milling costs at various plants in which he does this company an injustice by erroneously making its milling costs appear higher than those of any other company cited. By publishing the following figures you will set your readers right, and show that the Guanajuato district is doing good work, and that the milling costs at this company's plant, instead of being the highest, are as a matter of fact and record the lowest:

Milling and Cyaniding Costs at Guanajuato Con. Co.'s Plant. (Costs are in U. S. Currency.)

Year.	Milling.	Cyaniding.	Total.
1907	$0.61	$1.83	$2.44
1908	0.62	1.68	2.30

Anyone having particular reason for comparing these costs with countries other than Mexico should bear in mind that the above refer to dry metric tons.

C. V. R. COGSWELL.

Guanajuato, Mexico, April 26.

Short Zinc.

The Editor:

Sir—In your issue of April 3, F. L. Bosqui touches upon several interesting subjects in his letter on 'Short Zinc', and I trust you will be able to induce him to publish in full his information on those subjects. The iron in solution, which he speaks of as acting galvanically upon the zinc, causing brittleness and an abnormal consumption, must have been present as a ferro-cyanide compound, and I am surprised to hear that galvanic action took place between such a salt and metallic zinc. A different explanation of his phenomenon might be given if it were known how much free cyanide, alkali (NaOH or $Ca(OH)_2$), and precious metal was present in the solution being precipitated; also the percentage of ferro-cyanide compounds. Furthermore, was the precipitation taking place in steel or in wooden boxes? Large zinc-consumption occurs from other causes than galvanic action, one of which is an extremely rich solution. I have frequently had more than 60% of the zinc in the head compartment consumed in 24 hours when precipitating very rich silver solution, a great hole being left in the centre. I would like to hear the result of Mr. Bosqui's experience in the comparative effect upon precipitation in the use of steel and wooden precipitation-boxes. It would also be of interest if your other readers would contribute their experience on that subject. According to Mr. Bosqui, I take it, wood should be used in preference to steel as material for the construction of zinc-boxes.

H. T. WILLIS.

Parral, Mexico, April 14.

MINES AND PLANTS OF THE PITTSBURG SILVER PEAK.

Written for the MINING AND SCIENTIFIC PRESS
By HENRY HANSON.

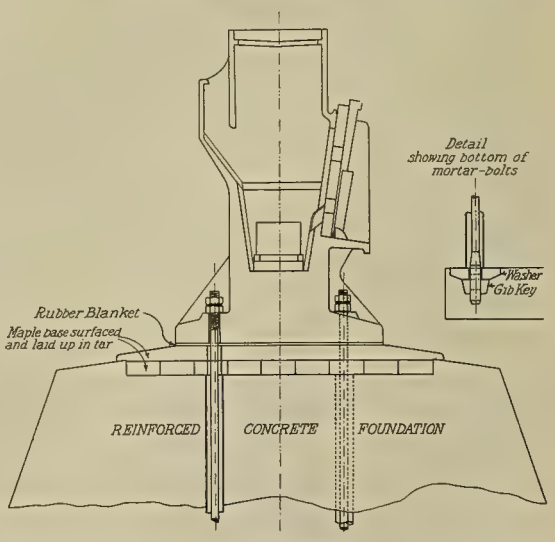
The mines and plants of this company are situated at Blair, Silver Peak mining district, Esmeralda county, Nevada. The company at the beginning of the present operations constructed a standard-gauge railroad 17½ miles long, connecting Blair with the Tonopah & Goldfield railroad. The district is one of the oldest in the State, and for the past forty years has produced a considerable amount of high-grade ore, which was hauled by wagon to the town of Silver Peak, where it was reduced in small plants. The mines had been almost idle several years, when the advent of the railroad and electric power line, resulting in cheaper milling, induced the present company, after the purchase of the Blair property and the consolidation of the Mohawk-Alpine group, to begin operations on a large scale. The mines are situated 2.7 miles from Blair. All machinery is electrically driven, power being furnished by the Nevada-California Power Co. The compressor-plant consists of one 8-drill 2-stage Ingersoll-Rand compressor and one 2-stage 25-drill Nordberg. The motor driving the latter machine is of the General Electric 2-speed type. The mines are provided with a complete machine shop and all modern conveniences.

The orebody dips about 30°. The ore is mined and trammed to large loading chutes, from which it is transported by electric motors to the crushing plant at the upper terminal of the tramway. The cars have a capacity of 3 tons each. They are built with rigid frames, and are dumped automatically. Two cars may be dumped at once. The tipple is actuated by compressed air, one cylinder throwing in the holding dogs, unlatching the side doors, and throwing the cars into dumping position. The crushing plant consists of one No. 6 and two No. 3 gyratory crushers. The ore is crushed in two stages to pass approximately a 1-in. ring. From the secondary crushing the ore is elevated and passes through the automatic sampling machines. The discard goes to the 400-ton tramway bin, where it is loaded automatically into the tramway buckets, which have a capacity of 800 lb. The tramway was built by A. Leschen & Sons Co. It has a length of 14,000 ft., with a total fall of 1600 ft. The capacity at normal speed is 450 tons per 16 hours. The ore is delivered to the mill storage bin, where the buckets are dumped automatically into a receiving hopper, from which it is taken by a 24-in. Stevenson-Adamson conveyor running the entire length of the 4000-ton mill storage bin. This conveyor is provided with an automatic traction-dumper.



Silver Peak Mill.

After thorough testing for a process suited to the ore, it was decided to use the Merrill system for the secondary treatment. The present mill-site was selected in order to obtain a gravity plant. Nothing was spared in the design, construction, and equipment to make the mill and its auxiliary departments a model in every way. Steel and concrete were used in the mill construction. The machine shop is at Blair, and has an equipment of machines and tools heavy enough to do all mine, mill, and railway repairs. The wood-working department is also complete with necessary machinery.



Mortar Foundations.

In the store department is a full and complete line

of mine, mill, and railway supplies, and repair parts, machine extras, and so forth.

The 100-stamp mill is of the usual type, containing, with 1050-lb. stamps, driven in units of 20 stamps each, by five 50-hp. Bullock motors. The stamps drop 96 times per minute, with a fall of 6½ to 7½ inches. The mortars are of special design, having massive bases with large area and are held in place by means of 8 foundation bolts. The manner of installation is shown in the illustration. The heavy reinforced concrete foundation is provided with a 6-in. built-up maple coping, surfaced perfectly true and laid up in tar. This coping is carefully cemented in place and provided with heavy rubber blankets between its top and the base of the mortar. The large cast-iron pedestal bases which receive the battery posts are also mounted upon the maple coping. The bottom of the mortar-bolts has the bolts enlarged with a keyway $^{9}/_{16}$ in. wide, which receives the gib-key as indicated. This gib-key engages the foundation washer as shown. Placed in the foundations so as to secure clearance in case it is necessary to remove the bolts, are pieces of 3-in. pipe. This type of construction has given excellent satisfaction, diminishing the usual failures of battery parts due to crystallization, which is invariably the case where mortars are mounted directly on a concrete foundation. The duty of the stamps, while it varies somewhat with the ore, will average 4 tons per stamp in 24 hours through a 35-mesh screen. The drop of the stamps, originally 105 per minute, with a 6½ to 7½-in. fall, was reduced to 96 per minute, the fall remaining the same. This change reduced both the repair and power cost, and did not reduce the tonnage. That there should be no decrease in tonnage on reducing the number of blows of each stamp over 8% can only be accounted for by the fact that there was not sufficient time intervening between the rapid blows to allow sufficient ore to lodge on the die to gain the maximum efficiency from each blow. Crushing is done with 5 to 6 parts of water to 1 of ore. Outside amalgamation is used. The plates have an area of 12.8 sq. ft. per stamp, and are set on a grade of 1¼ in. to the foot. The water supply is pumped from Silver Peak through 17,000 ft. of 6-in. standard pipe, against 550-ft. head, to a steel storage-tank 30 by 22 ft. deep placed behind the mill at an elevation of 40 ft. above the battery floor. For this service is used a heavy 7 by 12-in. Platte Iron Works single-action direct-connected triplex pump. Water in the battery tank, 20 by 16 ft. deep, is maintained at a constant level by a float-valve, operating automatically, and is supplied by the storage tank mentioned above, and also by overflow from clarifying and sand tanks. A third tank, 20 by 16 ft. deep, furnishes water for sluicing out sand and slime tailing, and is supplied by returning the clarified sluicing water from slime presses, as well as part of the water overflowing from the sand tanks while filling, and also the barren waste solutions.

The tailing, after passing the amalgamating plates, is conveyed to the distributing sump of the clarifying department in a wooden launder 12 in. wide by 8 deep, set with a grade of 1⅛ in. per foot. The bottom of the launder is covered with ¼-in. steel plate. A tipple is employed in this launder, through which the tailing may be temporarily turned to waste when necessary. Before entering the distributing sump the tailing passes through a screen box fitted with ½-in. steel trommel plate perforated with 7-mm. holes. This screen removes all wooden chips and coarse rock due to breaks in battery screens. The distributing sump, 3 ft. diam. by 4 deep, with a baffle-board, has two adjustable gates, which provides an even pulp-feed to each of the two settling cones. These cones are 8 ft. diam, with the sides sloping at an angle of 50 degrees. The stream of pulp is fed to the centre of the cone through a sump 12 in. square projecting 12 in. below the water-level. To the apex of each of the settling cones is bolted a multiple outlet casting, tapped to take four 1½-in. pipes. Each of these pipes feeds one of the sizing cones. The sizing cones are 4 ft. 3 in. diam. at the point of overflow, and have sides sloping 70°. The pulp-feed is introduced at the centre of the cone through an enlarged elbow submerged below the water-level to prevent all agitation. The sizing cones are fitted with the Merrill patented hydraulic sizers, by means of which a rising stream of clear water is caused to meet the falling sand. The water, being supplied at a low pressure, enters in such a way that no eddies or cross currents are produced. A thorough sorting is thus effected, the slime passing upward and overflowing the lip of the cone, while the coarse and fine sand pass out at the bottom discharge. Both settling and sizing cones are fitted with lead leveling strips to insure a uniform peripheral overflow. Special cocks and nozzles fitted with chilled-iron bushings are used to regulate and equalize both the feed and discharge of the sizing cones. The mill tailing is thus divided into two products—slime, the combined settling and sizing-cone overflow, and sand, discharged from the bottom of the sizing cones. The following figures as to the sizing of these products may be of interest:

	On 60 mesh, %	On 100 mesh, %	On 200 mesh, %	Through 200 mesh, %
Mill tailing	22.98	23.55	13.33	40.12
Classified sand	29.86	32.68	24.09	13.37
Slime	.....	.....	1.46	98.54

The tailing before classification, as has already been said, contains from 5 to 6 parts of water to 1 of solid. The sand after classification contains from 3 to 4 parts of water to 1 of solid, and the slime from 14 to 16 parts.

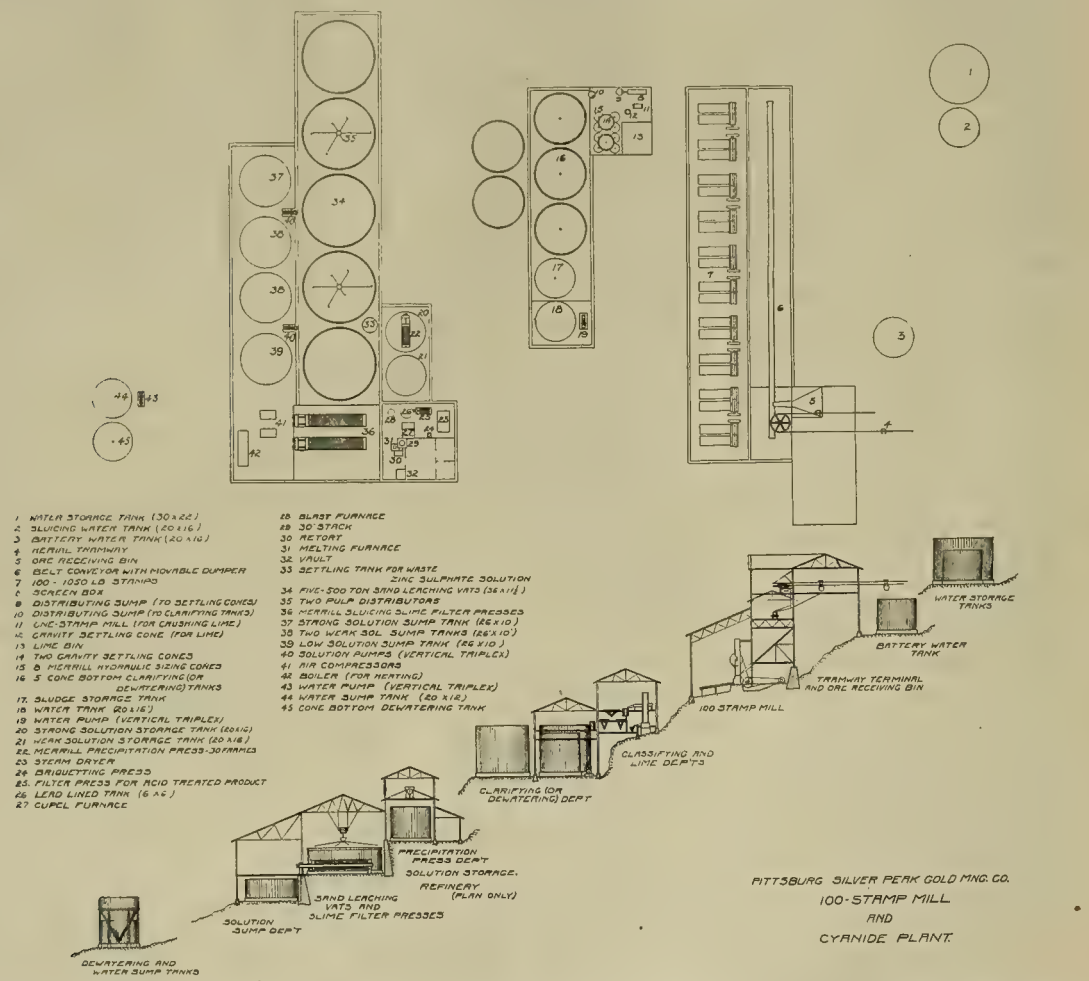
Lime is added to the sand in amounts varying from 2½ to 3½ lb. per ton. The lime is crushed wet in a 1-stamp battery through an 8-mesh screen. The manner of crushing causes the greater bulk of the lime to collect in unslaked granules, a fact that makes it possible to maintain a practically uniform protective alkalinity. The sand is then conveyed through wooden launders to the leaching tanks, where it is distributed by a mechanism of the garden-sprinkler type. These machines, two in number, are suspended from carriages on a track, and can be moved to any of the five leaching tanks. They were designed to insure an absolutely uniform distribution of the fine

and coarse sand throughout the charge, preventing all possibility of channeling during the subsequent direct treatment.

The leaching tanks, five in number, are 36 by 11½ ft. deep, and have annular launders to carry away overflow during the filling. The filter bottom consists of 2 by 4-in. pine placed on edge and spaced 2 in. apart, over which is spread a cocoa-matting and 8-oz. canvas filter. Each tank has a capacity of approximately 500 tons of sand, and under present conditions will fill in about 40 hours. When a tank has been filled, the drain valve at the bottom is opened, and the water in the saturated sand is allowed to drain. The drainage period requires about 14 hours, after which the treatment begins. This consists of alternating periods of air and solution, each air period being preceded by a drainage period. The unprecipitated standardized strong stock-solution is used during the earlier stage of the treatment. This is followed by a barren or precipitated weaker solution, which is in turn followed by wash water, used to displace the remaining gold-cyanide solution contained in the charge. The treated charge is then sluiced out through four side gates and one centre gate. One man with two 3-in. pipes with 1⅛-in. nozzles discharges a tank in about four hours. The water required for this purpose is approximately one ton to one of solid, including the water in the saturated sand. The whole cycle of treatment from charging to charging, at the present rate of filling, occupies a little over seven days.

The effluent solution from the sand charges is divided into three classes—'weak', 'strong', and 'low'. The 'weak' is the solution from the early periods of treatment, and flows to the weak or precipitating sumps, from which it is precipitated by being pumped through the precipitating press to the weak-solution storage-tank, thus becoming the barren precipitated solution which is used on the leaching tanks during the latter stages of treatment. The 'strong' solution is largely the effluent displaced by wash water, and flows to the strong-solution sump-tank, where it is standardized to the normal strength and pumped to the strong-solution storage-tank. The 'low' solution is the combined effluent from the first and final stages of treatment, low in cyanide, and kept at a sufficient tonnage to maintain the normal balance of solution in the plant. The sump tanks, four in number, one strong, one weak, and two low, are all 26 ft. diam. by 10 deep.

The combined overflow from the settling and sizing cones flows into a distributing sump with adjustable outlet gates similar to those mentioned in connection with the sand. From this sump five 'U' or round-bottomed galvanized-iron launders distribute the pulp to five clarifying or dewatering tanks. These



are 26 ft. diam. by 24 ft. 2 in. deep, built with a wooden cone bottom sloping 45 degrees. Each tank has an overflow launder bolted to the inside of the tank. The thickened slime as drawn continuously from an outlet at the bottom of the cone, contains from two to three parts of water to one of slime, and flows directly to a sludge storage tank or accumulator, 20 ft. diam. by 16 deep, with a 45-degree wooden cone bottom. The clear water overflowing the clarifying tanks is conveyed to a sump-tank 20 ft. diam. by 16 deep, from which is is pumped direct to the battery storage tank back of the mill by a 9 by 10-in. Aldrich triplex pump. Sufficient cyanide and lime are added to the sludge storage tank to make a solution of 0.025% cyanide with a slight protective alkalinity. The pulp is agitated constantly by air, and is drawn at regular intervals directly to the two filter-presses. The slime-presses are of the well known Merrill type,* containing 64 four-inch frames, filled from a 6-in. pipe under 30 lb. gravity pressure, and discharged without opening by means of the rotating sluicing pipe with water under 60-lb. pressure. Owing to the talcose nature of the Silver Peak slime, the usual method of direct treatment in the presses has been somewhat modified. Instead of filling the frames until a solid 4-in. cake has been formed, the slime-feed is shut off while there is still an opening of about ¼ in. at the centre of the frame. As the feed valve is closed, the solution or water valve is opened, and the leaching of the cakes begins from the centre outward, the water or solution being introduced to each frame through a sluicing nozzle or rotating pipe. While it is perfectly practicable to leach in the presses with a secondary solution, it is found that the gold in the slime, which occurs in a fine state of division, is fully dissolved in the sludge storage tank. The main purpose of the presses, therefore, is to separate the dissolved gold from the slime. The displacement of solution by wash water is satisfactory and complete, there being little tendency for slime to classify if the pulp is maintained at a reasonably high gravity. Approximately eight parts of water to one of solid are used in sluicing the presses, most of this water being recovered by settling in a cone-bottom tank 24 ft. deep by 20 ft. diam. The final slime residue going to waste averages about 2½ parts of water to 1 of solid, and could be discharged easily at 1 to 1 if desirable by providing greater settling capacity.

Zinc-dust is used for precipitation, the Merrill patented triangular press and process being used. Two distinct solutions are handled, the weak solution from the sand tanks and the combined low solutions from the sand and slime. A 12-in. rubber belt-conveyor, mounted on suitable rollers, is arranged to operate by means of floats and counter-weights at a rate proportional to the volume of solution pumped from the tank. The dry zinc-dust, being spread uniformly along the belt, is discharged into a mixing cone at a rate proportional to the tonnage of solution to be precipitated. A jet of air agitates the emulsion, and a small stream of barren solution provides a constant overflow, which carries the zinc-emulsion down a 1¼-in. pipe to the suction of the pump. No zinc is allowed to escape directly into the tank, and the precipitation takes place entirely during the passage of the solution through the pump, the pump-column, and the press. The latter contains thirty 2-in. triangular frames, 52 in. across the top, and has a total filter area of 450 sq. ft. The solution enters each frame from the top side channel and passes through a core to the bottom of the frame. Any zinc left in the frame from a previous pumping is kept in thorough agitation by the incoming stream of solution, and any excess of zinc deposited in the press during one pumping will be available for further precipitation during some future pumping. The efficiency of this method lies in the fact that the cloths are coated with a layer of powdered zinc and precipitate, so that every particle of solution having to pass through the cloth necessarily comes into intimate contact with the fine zinc, and also in the fact that to each tank of solution fresh zinc is added, assuring good precipitation, even of a solution containing copper. This can seldom be done with zinc-shavings, owing to their tendency to become inert when coated with copper.

The weak solution, after precipitation, flows to the barren weak-solution storage. The low solution is precipitated in like manner, but the barren 'low' flows to the water tank and is pumped to the sluicing tank, when it becomes the main supply for sluicing the slime-presses and sand tanks. One press serves for all solutions precipitated in the plant. It is necessary to clean the press twice a month. The cleaning and re-dressing with new cloths requires about four hours for two men. The filters used are changed at each cleaning of the press, but are washed and re-used several times. The following figures on precipitation are averages for March 1909:

	KCy. %	—Precipitation— Gold. Head.	Gold. Tailing.
Weak solution	0.095	$8.19	$0.016
Low solution	0.025	0.85	0.020

The refining process used at this plant is practically identical with that in use at the Homestake.* Briefly, it is as follows: The precipitate is taken directly from the triangular precipitating press and placed in a lead-lined steel tank, where it is made into a thick sludge by adding water and agitating with mechanical stirrers. The free zinc is dissolved by hydrochloric and sulphuric, or by sulphuric acid alone. After acid treatment the sludge is deposited in a small filter-press. The zinc sulphate and other salts soluble in the acid solution or in water are carried away to a waste tank. Several washes of hot water are used after the precipitate is in the press, to make sure that all soluble salts are removed. The press is then opened and the acid-treated product is placed on a steam dryer, where it is dried sufficiently to be screened and sampled. After this a flux, consisting

*'The Homestake Slime Plant', by Mark Ehle, *Mines and Minerals*, March 1907, and 'Cyanide Practice at the Homestake Mills', by F. L. Bosqui, MINING AND SCIENTIFIC PRESS, July 6, 1907.

*'The Metallurgy of the Homestake Ore', by C. W. Merrill, *Trans.* A. I. M. E., October 1903.

of litharge, borax, and ground coke, is added and mixed thoroughly with the precipitate. This mixture is then briquetted at a pressure of about 1000 lb. per square inch, the object being to avoid 'dusting'. The briquettes are melted in a cupel furnace. During the fusion the gold is thrown down in lead, while the slag is run off into pots and later re-run in a small blast-furnace, together with cupel bottoms, sweepings, and other by-products. The cupellation of the lead is carried on in the same furnace, and the lead is separated from the precious metals by blowing a light air-current across the surface of the molten metal, thereby oxidizing the lead, which is drawn off from the front of the cupel as rapidly as it is formed. The litharge takes out very little value, and is re-ground and used the following month as flux. The bullion from the cupel furnace is then cut up and re-melted in graphite pots and cast into bars for shipment. The amalgam from the stamp-mill, after retorting, is melted and cast into bars in the same manner.

All men employed in mill and cyanide plant work 8 hours. The regular mill-crew consists of 3 men on a shift. In addition to this number are 2 plate-men and 2 repair-men on the day shift, making in all 13 men for the 24-hr. day. In the cyanide department 4 men are employed on each shift, with no extras on the day shift, making the total cyanide crew 12 men for the three shifts. In the refinery 2 men are employed, on day shift only. Their work consists of cleaning the precipitation-press and carrying on all work connected with the refining of mill and cyanide products. In the assay office, where the assaying for the mine and plant, as well as some custom work, is done, 3 men are employed.

Below will be found tabulated costs per ton of ore milled for six months, including office, administration, and insurance expense, but not interest and depreciation of plant:

COST PER TON.

Month.	Milling.	Cyaniding.	Assaying.	Refining.	Total.
October	$0.932	$0.772	$0.068	$0.070	$1.842
November ..	0.913	0.681	0.072	0.113	1.779
December ..	0.773	0.677	0.079	0.095	1.624
January, '09.	0.760	0.630	0.062	0.159*	1.609
February ...	0.595	0.583	0.067	0.106	1.351
March	0.564	0.496	0.053	0.058	1.171

*Refining costs high this month, due to making a general clean-up of the solution sump-tanks, in which a gelatinous precipitate had been deposited while using brackish water from a salt marsh, which contained sulphates and carbonates.

These milling costs, as far as known, are less than one half those of other plants operating under conditions found in Nevada. The following figures relative to the cost of labor, power, and water for the entire milling plant (mill and cyanide) furnish an interesting comparison with similar data published of other Nevada companies:

Month.	Labor.	Power.	Water.	Total.
October	$0.594	$0.236	$0.194	$1.024
November	0.488	0.237	0.110	0.835
December	0.451	0.237	0.100	0.788
January, '09	0.433	0.213	0.103	0.749
February	0.374	0.199	0.080	0.653
March	0.389	0.198	0.081	0.668

The cost of chemicals per ton of ore treated for the same months were as follows:

Month.	Cyanide.	Zinc.	Lime.	Acid.	Total.
October	$0.221	$0.058	$0.047	$0.033	$0.359
November ..	0.190	0.046	0.047	0.030	0.313
December ...	0.194	0.044	0.044	0.021	0.303
January, '09.	0.176	0.060	0.037	0.060	0.333
February ...	0.160	0.036	0.032	0.025	0.253
March	0.106	0.017	0.036	0.013	0.172

For the last quarter of 1908 and the first quarter of 1909, 64,052 tons of ore were milled. The net Mint returns on the bullion shipped show a total recovery of 92.3% of the gross value of the ore. Of these recoveries, 66% were made on the plates and the remaining 34% by cyaniding of sand and slime. The method of treating the sand in the secondary plant is practically the same as that used at the Homestake, modified to suit the local conditions. In the selection of a process suitable to the ore, crushing in cyanide solution was carefully considered and rejected because of the importance amalgamation plays in the recovery, and the difficulty of maintaining amalgamation at a high efficiency when solution is passed over the plates. While some of the ore contains considerable lead and iron sulphide, and the presence of these, especially where the lead and iron sulphides occur jointly, are excellent indications of good assay-value; the concentration of the sulphides, however, does not materially concentrate the precious metals. Concentration is, therefore, impracticable. By fine grinding, a small additional recovery, dependent on the grade of the ore, could be obtained. This, however, would necessitate the installation of a re-grinding plant, and also more slime-presses, and it is not considered that the additional recovery would justify such an installation on a comparatively low-grade ore. George O. Bradley was employed by the company during the construction and erection of this work.

Coal occurs at many localities in the Rogue River valley of southwestern Oregon, between the Cascade mountains on the east and the Klamath mountains, locally called the Siskiyou mountains, on the west. A long narrow coal belt stretching to the south and southeast in the Rogue River valley east of Medford and Ashland, Oregon, and continuing through the Siskiyou Mountain divide into California, a total distance of nearly 100 miles, has been described by J. S. Diller of the U. S. Geological Survey.

Old steam-engine plants can practically be doubled in power by the addition of low-pressure turbines and about 40% more boiler-capacity. With this increase, the steam engine must be capable of developing its full power on atmospheric exhaust, and this demands some re-adjustment of the valve gears for smooth running. Naturally, the conditions of running and the proportions of the cylinders should be known before designing the turbines, so that the two may operate well together.

Carbon monoxide in chimney gases increases with the imperfect combustion of the fuel; hence it is generally connected with the emission of smoke.

ORIGIN OF THE GOLD OF THE RAND.

By John W. Gregory.

*The wealth of the Rand goldfield depends upon its sheets of gold-bearing conglomerate or pebble-reef, known as 'banket'.

The sedimentary origin of this pebble-reef is unquestionable. Opinions have differed as to whether the conglomerates were of fresh-water or of marine origin; but it is now generally agreed that they were laid down upon a sea-shore. This pebble-reef being sedimentary, it was natural at first to regard the gold as also of sedimentary origin, like the Cambrian placer-deposits of Dakota.

Facts, however, were soon forthcoming that led to the establishment of various other explanations, of which the most serious rival to the placer theory has been that which regards the banket as conglomerate that has been mineralized by the entrance of gold-bearing solutions; it is held that the solutions mineralized the pebble-beds and not the adjacent quartzites, as the pebble-beds were more open to the entrance of solutions than the fine-grained sandstones.

The gold-bearing conglomerates are members of the thick series of sedimentary rocks, including shale, quartzite, and conglomerate, which constitute the Witwatersrand system. They have been invaded by many basic igneous rocks and are disturbed by a complex system of faults.

The Witwatersrand system was at one time regarded as Devonian in age, but it is certainly older than that date. It may be Paleozoic, but the probability is in favor of its being pre-Cambrian. It is not in contact with any fossiliferous rocks earlier than those of Karroo, so there is no precise evidence of its age; but it is probably Algonkian. The Witwatersrand formation has been folded into a syncline about 100 miles long from east to west and about 50 miles broad from north to south. The Witwatersrand system is covered by a wide series of amygdaloids, which are themselves covered unconformably by a series of rocks beginning with the Black Reef series. This series is in turn covered by the dolomites of the Pretoria beds, and above another unconformity lies the Waterberg sandstones, which are regarded by some authors as Devonian but by others as pre-Cambrian.

The Witwatersrand System rests upon the weathered surface of an older granite, which was intrusive into some schists. These schists are therefore older than the banket and its interstratified quartzites. The schists are not now exposed near Johannesburg, but they probably once covered the granite in the hills to the north of the Rand. The intrusion of the granite probably led to the formation of numerous quartz-veins in the schists. The quartz pebbles of the conglomerates are doubtless fragments of such veins.

According to the placer theory, the quartz veins were auriferous and supplied the gold as well as the pebbles. The beds of pebble-reef or banket are found on various horizons; a bed may consist of one layer of conglomerate or of several seams separated by layers of quartzite and silicified shales. The separate beds of pebble-reef are thin, although they may have a great horizontal range. The conglomerate seams constantly vary in thickness; they disappear on one horizon, while another seam of conglomerate appears at a somewhat different level. The conglomerates in fact are subject to the usual variations of layers of shingle interbedded with sand along a coast. The most important beds of banket can be followed for great distances along the Rand.

All the conglomerate is not payable. The thicker seams, such as that known as the Main Reef, are often so poor in gold as to be unworkable. The richest ore comes from thin seams of conglomerate, such as the Main Reef Leader or the South Reef Leader. Even in the rich seams there are wide patches which are too poor to pay for mining with present costs; and these patches may be recognized on the stoping plans as large unworked areas that are usually lenticular in shape.

The arguments in favor of the impregnation theory have been summarized by Hatch and Corstorphine.[1]

The first fact on which they rely is that the gold is found in the matrix of the conglomerate and not in the quartz pebbles; but this feature is one of those in which the banket agrees with alluvial gold deposits. The quartz pebbles in a placer gravel are fragments of the more compact and denser parts of quartz lodes, and as a rule such quartz is barren. Gold is usually deposited in quartz lodes along cracks which allow the circulation of the auriferous solutions; and even if the cracks be completely filled, the sheets in the lode containing gold and metallic sulphides would be inevitably weaker than the intervening masses of compact 'buck-quartz'; hence when vein-quartz is being broken up into gravel, it breaks most readily along the auriferous layers. The first process in the treatment of ore at an ordinary placer mine is the separation of the barren quartz pebbles from the gold-bearing cement. The presence in the banket of the Rand of occasional pebbles containing gold as a primary constituent is, however, asserted on good authority. Such pebbles may occur, and if they are as scarce as in a modern placer, their rarity would justify the view that the gold is practically confined to the matrix.

The second argument against the placer theory is that the gold is not angular or water-worn, and occurs in crystalline angular grains associated with secondary crystals and concretions of pyrites. This well established fact, however, merely shows that the banket is not a modern unaltered placer. The Rand pebble reef occurs in one of the oldest of sedimentary rocks, and it has been subject to such intense pressure that abundant crystals of chloritoid have been developed in the quartzite, shale, and cement of the banket series. In the compression of the conglomerate the fine flakes of soft gold were inevitably squeezed into the crevices between the hard sand grains and thus received their jagged angular outlines.

*Abstracted from a paper read and discussed before the Institution of Mining and Metallurgy, London, and summarized by the author in *Economic Geology* of March 1909.

[1] 'Geology of South Africa.' 1905. Page 146.

The gold is often associated with rounded concretions of pyrite, and the theory that the Rand is an old placer deposit has been prejudiced by the argument that all these rounded pieces of pyrite are rolled pebbles. It has been held that as the rounded pellets of pyrite are of alluvial origin, so also was the gold associated with them. But the occurrence of rounded pebbles of pyrite on an ocean beach is most improbable from chemical considerations. The advocates of the infiltration theory insist, and no doubt justly, that these rounded pieces of pyrite cannot have been originally pyritic pebbles. Some of them may be concretions; but the typical pebble-like pyrite and many seams of pyrite, which in their arrangement closely resemble the layers of black iron sand on a sea beach, are, in my opinion, pseudomorphic after iron oxide. Some of the pebble-like fragments of pyrites were certainly beach-worn pebbles; but they were pebbles of hematite, which has been converted into pyrite.

The crystalline nature of some of the gold is also natural in so ancient a deposit; since it has probably been dissolved and redeposited during the formation of the pyrite, much of which is admittedly of secondary origin. According to my opinion, much of this pyrite is altered black iron sand; the iron oxide has been converted into sulphide, and the ferric sulphate solutions formed during this reaction probably dissolved the fine gold and re-precipitated it almost in place.

In the discussion before the Institution of Mining and Metallurgy stress was laid by some advocates of the infiltration theory on the improbability of the solution and precipitation in place of gold. In the paper then discussed the Kanowna lead in Western Australia was quoted as an example of the localities where this process must have occurred. The Cambrian placer deposit near Deadwood, South Dakota, provides another and better known illustration.[2] The evidence in that case was clearly stated by W. B. Devereux, and it has been advanced with still greater authority by J. D. Irving.[3] "The gold," says Professor Irving, "is known to occur in two conditions: detrital gold and chemically precipitated gold; in addition, much of it may have been introduced with pyrite." He concludes, "Unfortunately, it does not seem possible to determine what proportion of gold in the pyritic conglomerate is detrital or was there before the pyrite was introduced. There is also a possibility that some of the gold in the lower and unoxidized portions may be precipitated gold resulting from secondary concentration."

The solution and precipitation of the gold in these Cambrian placers has indeed led to the view that they owe all their gold to infiltration. But in this case the gold is coarse and the rocks unaltered; so that the rounded detrital form of the gold has been retained.

The third argument advanced in support of the infiltration theory of the formation of the Rand is the uniform distribution of the gold. This uniformity has, however, been exaggerated in the literature. It has been stated that the banket is as persistent and uniform in its yield as a coal seam. But such is not the case. The detailed assay-plans of the mines show that the banket is subject to sudden and extreme variations in value.

The variations affect both adjacent samples and the average yield of large areas of the pebble-reef. Frederick Hellmann, of the East Rand Proprietary, has prepared diagrams showing the variations in value along a continuous band of reef; and he has aptly called them his "icicle diagrams," as the line representing the gold values rises and falls as sharply as the outline of a row of icicles. The irregular distribution of the gold in the pebble-reefs could be illustrated from the assay-plans of most of the mines. Similarly adjacent areas show great variations of value. One has only to consider the fact that in the year 1904, out of the 64 producing mines on the Rand only 33 paid dividends to realize that the gold yield of the reef is not uniform; and study of maps showing the distribution of the producing mines along the Rand, or a traverse in the field of the large unworked gaps in the line of mines between Krugersdorp and the East Rand affords impressive proof of the irregularity of the gold distribution. The gold-bearing banket has admittedly a greater length of rich ore than any other marine placer; but it does contain wide barren sections, and the rich deposits contain barren patches, like ordinary placers.

The fourth objection to the placer theory is the restriction of the gold to certain definite beds. This arrangement is, however, not inconsistent with the alluvial origin of the pebble-reef, for it is actually the rule in placer deposits. The nature of the restriction of the gold distribution in fact affords one of the strongest proofs of the detrital origin of the gold.

A further argument against the placer theory is worthy of notice, as much stress was once laid upon it, though the argument has been generally abandoned. It was the absence of nuggets or of coarse-grained gold. This fact admits of two simple explanations. When alluvial gold is derived from reefs, in which the gold is present only in fine particles, then the gold in the placers formed by the denudation of these reefs is also fine. In the case of the Rand, even if there had been coarse gold in the reefs it would probably not have reached the shore deposits: for rivers were probably the main agent in the destruction of the gold-bearing reefs; and any heavy gold that they may have obtained from the reefs would have been deposited on the river bed, or ground into fine particles before it reached the sea. As with the placers on the western coast of New Zealand, only the fine gold would have been carried onto the beaches, and then distributed by the currents along the shore.

The objections to the placer theory seem to me therefore all invalid; while those to the impregnation theory appear insuperable. No trace has yet been discovered of the 'verticals' or channels up which the solutions were introduced. In mining districts

[2]W. B. Devereux, 'The Occurrence of Gold in the Potsdam Formation, Black Hills, Dakota', *Trans.* Amer. Inst. Min. Eng., Vol. X, 1882, p. 471.

[3]J. D. Irving, 'Economic Resources of the Northern Black Hills', Prof. Paper U. S. Geol. Surv., No. 26, 1904, pp. 109-111.

where sedimentary rocks have been mineralized by infiltration, as, for example, in the Cambrian gold ores of South Dakota, the channels by which the gold was carried into the sedimentary layers have been easily discovered. They are so clear that they have been illustrated by convincing photographs. No such channels have been discovered on the Rand.

The conditions under which the gold was introduced into the pebble-reef on the placer theory are shown by the nature of the reef and its pebbles. Before visiting the Rand I was unable to decide between the placer and infiltration theories, because, among other reasons, of the richness of the 'banket' in such fine gold. The most striking difference between the banket and any modern placer is that the gold is exceptionally fine-grained in proportion to its richness. I was, before visiting the Rand, prejudiced against the placer theory, as I failed to understand how such fine gold could have been concentrated into such rich seams. Equally fine gold is known in river placers; but it is there distributed through thick beds of fine silt, which would never have paid to work under such geological conditions as those of the Rand. Inspection of the richest seams of banket at once removed the difficulty, which was due to my not having allowed for the difference between marine and river placers. The richest seams on the Rand have large, well rounded pebbles, which show by their form that they have been subject to strong currents; the layers with angular pebbles—the bastard reef—are practically always so poor that they are unpayable, though assays show that some gold is generally present in the material. The richest deposits, like the Main Reef Leader, are thin layers of conglomerate, containing large, well rounded pebbles; the pebbles are sometimes thicker than the bed in which they lie, so that they project well above its upper surface into the quartzites.

Such layers were formed as sheets of shingle upon a sea-shore swept by strong tidal currents. The bun-shaped form of the pebbles, with their flattened base (the significance of which was explained by Becker) shows that they were spun around as they were moved backward and forward by the scour of the tide and thus the base worn flat. The waves breaking over them would have swept the light silt and mud from between the pebbles and the interspaces thus formed would have served as riffles; in the shelter of which the heavy gold would have collected. Thus there would have been a slow concentration of fine gold in the layers of coarser shingle which had been for a long while exposed to the surf. The formation of the bastard reef, on the other hand, would not have been accompanied by such concentration, for the angularity of its pebbles shows that it was not washed and rounded as thoroughly as the true banket. Hence, though gold is present, it occurs in such small quantities that the material does not pay to mine.

The distribution of the gold throughout the Rand agrees in its essential characters with its distribution in placer deposits. The gold is usually richest on the foot-wall side of a seam. The rare cases of the occurrences of visible gold in the banket appear to be practically always on the foot-wall surface of the seams. And when a bed of pebble-reef consists of several seams of conglomerate separated by an intervening layer of quartzite, it is usually the lowest seam that is the richest. This rule is of course not universal, and on the 'marine placer' theory exceptions would be expected; for the tidal scour would be strongest now at one point on the beach and now at another. Gold concentration would take place most effectively at different localities as the beach deposits were being accumulated. This connection between the concentration of the gold on slightly different horizons and the physical nature of the conglomerates is well shown by the continuous reef sections which have been prepared for many of the Rand mines.

The agent that spread the gold through these thin beds of shingle was one that had a widespread horizontal range of action, and was limited for each sheet to a narrow vertical range. This distribution is consistent with the action of the surf on a shore; but it is wholly inconsistent with the behavior of a mineralizing solution percolating through a series of sands and pebble beds. Occasional layers of shale in the Rand series would no doubt have been impermeable to the solutions and would have escaped mineralization, although they contain some gold; but the rich beds of banket often rest on thick layers of pebble beds, the bastard reef, which would have been as freely open to infiltrating solutions as the banket. Becker has clearly shown the fallacy of the assumption that the coarse sandstones associated with the pebble beds would have been comparatively impermeable. And the bastard reef must often have been more open to solutions than the adjacent banket, when the latter consists of large pebbles in a compact matrix.

It is so obvious that any gold-bearing solutions that circulated along the layers of banket must have percolated into the underlying bastard reef that the suggestion has been made that the distribution of the gold was determined by some precipitant present only in the banket. The precipitant suggested is organic matter, as traces of carbon have been found; but the organic matter would have existed equally, and probably even more abundantly in the quickly accumulating bastard reef, as it was subject to less violent scour than the banket. So far there has been no adequate evidence of any precipitant that would explain the deposition of the gold in the surf-washed Main Reef Leader, and would be absent from the underlying bastard reef.

Probably the weightiest evidence between the two theories is that afforded by the microscopic structure of the ores, as that evidence can be most easily adduced. The microscope when applied to thin sections of an ore reveals the actual history of its formation. If the banket had been impregnated by solution the microscope should discover the channels along which the gold has come. The microscope shows that the deposits have been silicified; that chloritoid is abundant and has probably, as usual, been developed by pressure; and that the iron pyrite is secondary; but it reveals no evidence of mineralization by solution as in an ordinary gold-quartz vein. Where gold ores

have been formed by solution acting upon older rocks, the solutions have altered the rocks into sheets of vein-quartz, which in the less altered specimens show remains of the original minerals. But microscopic sections of rich specimens of banket show that they have been no more altered than quite poor specimens.

The petrographic evidence shows that the minerals characteristic of the banket, such as the chloritoid (ottrelite) are characteristic of pressure and earth movements, and not of the action of mineralizing solutions. Pyrite is no doubt often present in gold-quartz veins; but it is still more widely distributed in clays, in which it has been formed by the action of sulphuretted hydrogen derived from decomposing organic matter on iron oxides.

Until the advocates of the impregnation theory discover the channels up which the gold has been introduced, produce evidence of adequate chemical change in the rich banket, explain the limitation of the gold to certain horizons and its absence from equally permeable or even more permeable adjacent layers, the impregnation theory must remain as a hypothesis with very little evidence in its support. On the placer theory there is no difficulty in understanding the introduction of the gold into the banket and its present distribution.

Native sulphur near Thermopolis, Wyoming, according to E. G. Woodruff of the U. S. Geological Survey, occurs in two forms—in small yellow crystals filling veins or cavities in the rocks, and massive where the original structure of the limestone is retained but where the calcium carbonate is replaced by sulphur. The sulphur is found in crevices, channels, or cavities such as watercourses make where they traverse limestone beds. The cavities seem to be portions of subterranean channels through which hot sulphur-bearing waters flowed, and on the walls of which the sulphur was gradually deposited until the chambers were completely filled or, in some places, only partly filled before the passage was stopped at some point and the water diverted to other channels. No regular arrangement of the cavities can be discovered, although they seem to occur in groups at places where the water found free passage. In areas between the groups of cavities only a small amount of sulphur is present, but in the enriched pockets the amount reaches 30 to 50% of the rock or even more, and becomes commercially important. Some of these abandoned watercourses are arranged in a close network, with the interspaces so completely mineralized that the whole area is now a mass of sulphur. Laterally a deposit may be rich at one point and barren 10 ft. away. The sulphur ore thus varies from a low percentage associated with barren rock to small masses of the almost pure mineral, but as the deposits follow no general laws, all of the area where geologic conditions are favorable must be tested to find them.

To authorize a private person to maintain an action to abate a public nuisance he must show a special injury, different in kind and not merely in degree, from that suffered by the public generally.

YERINGTON COPPER DISTRICT, NEVADA.

The copper mines and prospects in the vicinity of Yerington, Nevada, were examined during the season of 1908 by F. L. Ransome of the U. S. Geological Survey, and a report of the work has just been published (Bull. 380). The town of Yerington is in Lyon county, in that part of western Nevada which lies between Tahoe and Walker lakes, and the nearest railway station is Wabuska, 12 miles to the north. The town is in the middle of Mason valley, through which Walker river flows northward for some 25 miles before turning to the east, near Wabuska, around the north end of the Walker range, on its course to Walker lake. The principal copper mines are west of the town, in the mountain ridge of which the Indian name is said to be Singatse. It is also called the Smith Valley range. The ridge has an average width of 4 miles, and the crest is from 1600 to 2600 ft. above the valley at Yerington, or from 6000 to 7000 ft. above the sea. The mines constitute a chain about two miles long, lying on the east slope of Singatse ridge, about half way between valley and crest, 4 to 8 miles from Yerington. At present operations are confined to developments in the zone of sulphide ore or, at one mine, in a zone of mixed sulphide and oxidized ore. Another group of copper prospects lies in the low hills 4 or 5 miles southeast of Yerington. The total quantity of oxidized ore exposed in the district is small, and there is no indication of any extensive sulphide enrichment. The quantity of gold or silver in the ores is practically negligible. The future of the mines depends on the working of low-grade primary deposits. The conditions are in some respects favorable for cheap mining and concentrating; a railroad could be constructed from Wabuska along Walker river with little difficulty. Water is more plentiful than in some other parts of Nevada, and many agricultural products can be grown in Mason valley.

The Tres Hermanas mountains rise from the general level of the high plateau about 25 miles south of Deming, N. M., and 10 miles north of the Mexican boundary line. The highest of the peaks attains an elevation of more than 7000 ft. above sea-level. Lead was discovered in this group at an early date, and for many years mines in the northern part of it have yielded a moderate production, possibly to a total value of $200,000. In 1904 attention was attracted to a heavy white massive or crystallized material occurring plentifully in old lead workings, and this material was found to consist of carbonates and silicates of zinc. The zinc ores include large quantities of the unusual mineral willemite (the pure anhydrous silicate of zinc), smithsonite (zinc carbonate), hydrozincite (basic zinc carbonate), and calamine (hydrous zinc silicate). Shipments of the zinc ore were made to smelters in the Mississippi Valley in 1905, but in 1906 and 1907 little activity was apparent. A geologic examination of the north end of the Tres Hermanas district was made during the field season of 1908 by Waldemar Lindgren of the U. S. Geological Survey.

DISCHARGE FORMULAS FOR CAST-IRON PIPE.

By George L. Bean.

*I have made a comparison between a simple formula recently presented by C. C. Vermeule, a rough formula of my own, and the various standard formulas for discharge of water from cast-iron pipe, with the following result:

Twelve formulas were calculated for slopes of 2 to 5 ft. per 1000, and for diameters of 4 to 30 in. Of these only three give concordant results, namely, those lettered (*c*), (*h*), and (*o*). Taking the formula

TABULAR COMPARISON OF VARIOUS PIPE-DISCHARGE FORMULAS. FOR CLEAN CAST-IRON PIPE; DISCHARGE IN UNITS OF 1,000,000 GALLONS PER 24 HOURS.

Formulas Tabulated:	Source:
(*a*) $Q = 0.05\ d^2\sqrt{d\ s}$	Vermeule, Engineering News, January 21, 1909.
(*b*) $Q = 0.001760\ d^2\sqrt{h\,d}$	
(*c*) $Q = 0.00354\ d^2\sqrt{\frac{h}{F}}$	Weston's tables, $v = \sqrt{\frac{h}{F}}$
(*d*) $Q = 0.00354\ d^2\sqrt{\frac{2\,g\,r\,i}{m}}$	Fanning, $v = \sqrt{\frac{2\,g\,r\,i}{m}}$
(*e*) $Q = 39.528\ D^{2.694}\ s^{0.555}$	Lampe, $q = 61\ D^{2.694}\left(\frac{H}{L}\right)^{0.555}$
(*f*) $Q = .30578\ d^2\ D^{\frac{5}{7}}\ S^{\frac{4}{7}}$	Flamant $v = 86.38\ D^{\frac{5}{7}}\ S^{\frac{4}{7}}$
(*g*) $Q_{.010} = 1.68\ Q_{.015}$	From Kutter's formula (and Swan & Horton)
(*h*) $Q = 0.00354\ d^2\ c\sqrt{RS}$	Darcy, $v = c\sqrt{RS}$
(*k*) $Q = 0.00354\ d^2\ (97.05\sqrt{RS} - .08)$	Prony, $v = 97.05\sqrt{RS} - .08$
(k_1) $Q = 0.00354\ d^2\ (99.88\sqrt{RS} - .154)$	" $v = 99.88\sqrt{RS} - .154$
(*m*) $Q = 0.00354\ d^2\ (108\sqrt{RS} - .13)$	Eytelwein, $v = 108\sqrt{RS} - .13$
(m_1) $Q = 0.177\ d^2\sqrt{\frac{D\,H}{L + 50\,D}}$	" $v = 50\sqrt{\frac{D\,H}{L + 50\,D}}$
(*n*) $Q = 0.16992\ d^2\sqrt{\frac{D\,H}{L + 54\,D}}$	Hawksley, $v = 48\sqrt{\frac{D\,H}{L + 54\,D}}$
(*o*) $Q = 0.00354\ d^2\ (140\sqrt{RS} - 11\sqrt[3]{RS})$	Neville, $v = 140\sqrt{RS} - 11\sqrt[3]{RS}$

The symbols have the following meaning:

v = velocity, feet per second.
Q = discharge, units of 1,000,000 gals. per 24 hrs.
q = discharge, cubic feet per second.
d = diameter of pipe, inches.
D = diameter of pipe, feet.
s = fall in unit length.
h = fall in ft. per 1,000 ft.
H = fall, total.
L = length, total.
S = sine of slope.
R = hydraulic radius, ft.
F = Weston's factors.
c = Darcy's constants, having values as follows:

d	4	6	8	10	12	16
F	1.161	.722	.522	.408	.335	.247
c	102	105	107	109	109.5	110.5

Fall, 2 ft. per 1,000.

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*k.*	k_1.	*m.*	m_1.	*n.*	*o.*
4″	.071	.080	.074	.068	.083	.081	.065	.075	.067	064	.071	.072	.070	.068
6″	.197	.220	.210	.196	.199	.244	.193	.206	185	.181	.202	.198	.191	.195
8″	.404	.437	.442	.426	.436	.529	.435	.444	.385	.378	.420	.416	.390	.408
12″	1.115	1.245	1.240	1.240	1.300	1.600	1.360	1.250	1.070	1.060	1.170	1.110	1.070	1.160
24″	6.310	7.040	7.170	7.850	8.400	10.500	9.200	7.220	6.100	6.100	6.700	6.160	5.900	6.800
30″	11.000	12.300	12.560	13.800	15.400	19.200	16.900	12.600	10.700	10.700	11.750	10.600	10.200	12.000

Fall, 3 ft. per 1,000.

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*k.*	k_1.	*m.*	m_1.	*n.*	*o.*
4″	.087	.097	.091	.085	.104	.104	.081	.091	.082	.080	.089	.089	.085	.086
6″	.242	.270	.258	.242	.250	.316	.236	.260	.230	.227	.251	.242	.234	.246
8″	.496	.536	.550	.526	.546	.684	.533	.543	.475	.471	.520	.498	.479	.514
12″	1.370	1.525	1.520	1.540	1.630	2.070	1.660	1.530	1.320	1.315	1.440	1.360	1.310	1.450
24″	7.740	8.620	8.770	9.660	10.500	13.600	10.300	8.850	7.500	7.600	8.300	7.540	7.200	8.550
30″	13.500	15.050	15.360	16.950	19.200	24.900	20.700	15.500	13.200	13.300	14.500	13.000	12.400	14.900

Fall, 4 ft. per 1,000

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*k.*	k_1.	*m.*	m_1.	*n.*	*o.*
4″	.101	.143	.104	.099	.122	.120	.093	.106	.096	.094	.105	.103	.099	.102
6″	.279	.311	.300	.282	.293	.363	.273	.300	.267	.265	.292	.280	.270	.289
8″	.572	.620	.624	.613	.641	.715	.615	.615	.552	.550	.605	.575	.552	.605
12″	1.580	1.760	1.752	1.790	1.910	2.380	1.920	1.780	1.520	1.520	1.680	1.570	1.510	1.700
24″	8.900	9.950	10.116	11.200	12.360	15.600	13.000	10.200	8.700	8.800	9.600	8.700	8.300	9.950
30″	15.600	17.400	17.750	19.600	22.500	28.700	24.000	17.900	15.200	15.400	16.800	15.000	14.300	17.500

Fall, 5 ft. per 1,000.

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*k.*	k_1.	*m.*	m_1.	*n.*	*o.*
4″	.113	.126	.117	.111	.139	.136	.105	.118	.108	.106	.117	.114	.110	.115
6″	.312	.348	.335	.319	.332	.412	.305	.336	.299	.298	.328	.314	.302	.326
8″	.640	.692	.698	.692	.725	.893	.686	.702	.617	.618	.680	.644	.618	.682
12″	1.760	1.970	1.960	2.040	2.160	2.700	2.240	1.980	1.710	1.720	1.880	1.750	1.690	1.930
24″	10 000	11.100	11.320	12.600	14.000	17.700	14.500	11.400	9.800	9.800	10.750	9.800	9.300	11.200
30″	17.400	19.450	19.840	22.000	25.500	32.500	26.800	19.950	17.100	17.300	18.900	16.800	16.000	19.900
60″	....	109.8	113.5	....	....	....	....	114.0	....	....	....	....	....	115.5

*Abstracted from *Engineering News*.

(*c*) as a standard, the other two compare extremely well with it. An approximate agreement with these is found also in the two simple or rough formulas (*a*) and (*b*). The former is, for 4 in. diam., 3% too low (which is close enough), and for 30 in., 12% too low (not close enough), the variation increasing with the size of the pipe. Formula (*b*) is recommended for pipes from 6 in. diam. up, the discharge being about 4% in excess for 6 in. to about 2% too low for 60 in. with a slope of 5 in 1000 (an extreme slope, giving about three times the economical velocity for 60-in. pipe). Formulas (*c*), (*h*), (*o*), and (*b*) apply to long, clean, cast-iron pipes as ordinarily used for water-supply and distribution systems.

SPECIFIC GRAVITY OF CONCENTRATE.

Written for the MINING AND SCIENTIFIC PRESS
By EDGAR B. VAN OSDEL.

Several years ago, while chemist for the Frisco mine, in the Coeur d'Alene, I had occasion to make frequent specific gravity determinations on various sizes of concentrate. These determinations were useful chiefly on account of the large amount of magnetite associated with the galena, and also in checking the quality of the zinc concentrate and tailing.

The first two compartments of the jigs would make a good grade of lead, but the third invariably produced a mixture of clean sphalerite with particles of the same specific gravity, but consisting of galena and magnetite. This was afterward run through a magnetic separator, which removed the latter product from the zinc. Likewise, on the tables, between the bands of lead and zinc, appeared a black band of this galena-magnetite mixture. Hence the necessity for specific gravity determinations to check the work of these machines. For the large sizes, at first, the regular method of weighing a particle suspended first in air, then in water, was used. Then the usual calculation of $\frac{W}{W - W'}$ gave the desired result. But the finer concentrate could not be treated in this manner, and since $W - W'$ represents the displacement of water in grams, the following scheme was used: A burette is filled to some convenient point, approximately 30 c.c., with water of the proper purity and temperature, and a reading taken. Then as large an amount of concentrate as can be conveniently handled, say 20 gm., is weighed accurately and transferred by means of a sheet of glazed paper to the burette. Of course much of it adheres to the sides of the burette and must be washed down by inverting it when closed by the thumb. When the dry concentrate is all moistened and settled below the water the second reading may be taken and the weight of the displaced water in grams calculated. The weight of the sample divided by this gives the specific gravity.

This method proved so satisfactory and so accurate on account of the large sample that it was also applied to the larger sizes by crushing them small enough to enter the burette before weighing. In this case, however, care must be exercised to prevent loss from dusting, since material lost in this way proved to be the softer and heavier galena.

CONTINGENT FEES.

By H. M. CHANCE.

*It will perhaps be admitted that an advocate, a partisan, or a promoter may properly accept compensation which in amount is contingent upon the success or failure that attends his efforts. Doubtless it will likewise be thought proper for a manager, inventor, or constructor to agree that the amount of his compensation shall depend upon the result achieved. Whether it be proper or expedient for an advisor or counsellor to agree that his services shall be paid for by their value, as measured by economic or financial results, is not so clear.

We have not the temerity to ask whether an appraiser, an arbitrator, or a judge may properly be compensated in proportion to the value of his findings to any of the parties in interest, for such a query appears absurd and its proponent ridiculous. To discuss this matter of contingent fees or contingent compensation intelligently, it therefore seems necessary first to define the position of the 'engineer', to learn in what capacity he is acting, whether as advocate, promoter, manager, advisor, or judge, and whether his position is a business or commercial one, or is purely professional.

As the engineering profession embraces those engaged in many widely different fields of activity; as many who are normally or usually employed in a certain class of work often enter some other sphere, where their duties, relations to principals and to the public are radically changed, recognition of these conditions becomes imperative before questions of ethics or of business or professional expediency can profitably be discussed. Those engaged in managerial work cannot adopt rules of conduct which might be formulated for those engaged in purely advisory work; nor can the tenets held by the salaried employee be applied to one who may be owner, vendor, or promoter. It seems to me that the Society should endeavor to define, in some way capable of easy application, the difference between the advisory functions of the engineer when reporting upon or appraising the value of properties, and those other functions which he may perform as manager, as part owner, as promoter, or as a business representative. The confusion of the public as to the proper place of the engineer arises from the many different spheres of activity to which engineers turn their attention, or into which they are drawn, in their efforts to make a livelihood.

When an architect becomes the superintendent of construction for a firm of contractors, for the time being he ceases to be recognized as a professional architect; when a civil engineer becomes division superintendent of a railroad, he is no longer a civil engineer; and even when a lawyer becomes president of a corporation, the public no longer regards him as a professional man; yet many mining engineers continue to be known as mining engineers for many years after they may have ceased entirely to do any professional work. This breeds confusion in the public

*Abstracted from discussion before the Mining and Metallurgical Society of America.

mind, and a vague idea that the mining engineer is properly manager, inventor, promoter, or advisor at the same time, and consequently may be expected to act as his interests and those of his principals may require. For reasons that are well known, those engaged in consulting practice and those engaged in teaching more generally receive public recognition as professional workers than those employed in managerial or commercial work, but as the latter are constantly changing positions with the former, it seems impossible to prevent misconception as to what constitute proper rules of conduct.

When acting as advisor, appraiser, arbitrator, or judge of property, the engineer might consider a contingent fee or contingent compensation as impossible of contemplation; if acting as a vendor, promoter, part owner, in matters connected with the sale or financing of property, the engineer might consider it proper to accept compensation contingent upon the financial outcome of the project; if acting as manager, inventor, constructor, or designer the engineer will likewise claim the right to be paid in proportion to the degree of success or failure that attends his efforts. It would appear then that the only part of the question that is debatable is whether an engineer acting as advisor, appraiser, arbitrator, or judge of the value of property can in any circumstances be justified in accepting a contingent fee.

COOLING TOWERS.

By Samuel K. Patteson.

*Of all the recent developments in the construction and operation of power-plants, the cooling tower has advanced with probably greatest rapidity. As an engineering development it has passed the experimental stage. While the prime object is the same, cooling towers have been installed for two entirely different reasons; first, the difficulty of obtaining large supplies of water, or its procurement at large cost, and, second, the necessity for using water undesirable on account of impurities.

The cooling tower is based simply upon the absorbing power of the air for water-vapor and the consequent cooling of the water from which this vapor is obtained.

Generally speaking, there have been two kinds of cooling towers developed, as a result of experiment and use, and these are called, respectively, the closed and the open or atmospheric type. These two types are in many respects the same, in that both consist of a square, rectangular, or round tower rising into the air from 20 to 60 ft., and having water-pipes for conveying the hot water to the top, with various sprinkling devices at that point to spray or distribute the water. The closed type differs, in theory at least, from the open type, only in the fact that the sides are closed and contact of the water with the air is accomplished by means of a power-fan placed at the base and forcing the air over the water. On the other hand, the atmospheric type has open sides to permit a free circulation of air.

The large surface necessary for exposure to the air is obtained in many ways; for instance, the Burhorn and Hart types utilize a series of large shallow pans, one above the other, and slightly tilted, the alternate pans being parallel with each other, and the water either overflowing in these pans or escaping through a series of holes made in the bottom of each pan at the lower edge, falls by gravity over the bottom of each pan in succession. Slabs of wood or slate, similarly arranged and for the same purpose, are used in other designs. In another type the water is allowed to run into a series of horizontal parallel V-shaped pans, which overflow when full, and the overflow is caught by a similar series of pans placed below the first, and so on through the entire height of the tower; or the V-shaped pans may have apertures in the apex of the V, thereby allowing the water to escape to the lower levels. In the closed type, the Alberger tower has a series of horizontal parallel cypress planks, equidistant from each other and resting on their narrow surface, superimposed at right angles upon another similar series, and so on for a number of layers; while the Worthington tower consists of short vertical lengths of interlocking galvanized pipe arranged in layers, to permit of dividing the water into innumerable channels as it descends.

In comparing the relative efficiency of the two types, the closed type was formerly considered to be superior, due to the fact that the fan was supposed to force much more air over the surface of the water than in the atmospheric type. It is found that the air rapidly becomes saturated, and is ineffective during the latter part of its passage over the water. In this type, therefore, a given quantity of air, forced into the lower part of the tower, must, in ascending, come in contact with and move parallel to constantly falling streams of water, and after absorbing from the water which it first reaches, its full quota of water-vapor, it is practically useless during the remainder of its progress; whereas in the open type the descending water is brought into contact with an air-current moving nearly always at a right angle to it, and never parallel, so that the water passes through successive layers of air that will take the water-vapor from it. It is therefore recognized today, from an operative point of view, that the atmospheric type is superior in cooling efficiency. The fact that in the closed type the operation of the fan requires power, and that this latter must be considered as a cost factor in the operation of the plant, has also enabled the open tower to successfully compete with its rivals.

*Abstract from Cassiers Magazine.

The quantity of salt produced in this country in 1908, according to statistics compiled by the United States Geological Survey, amounted to 28,822,062 bbl. of 280 lb., valued at $7,553,632, a decrease of 882,066 bbl. in quantity and of $54,691 in value from the output in 1907. Expressed on a tonnage basis, these quantities represent an output of 4,035,089 short tons in 1908, or 123,489 short tons less than the production in 1907. The average net value of the product in 1908 was 26.208c. per bbl., or $1.87 per short ton, as against 25.614c. per bbl., or $1.83 per ton, in 1907.

Evolution of an Idea.

Mining is as old as civilization, and prospecting still more ancient. The crooked stick served our forefathers for a plow about the time the miner began using the horn spoon in his search for gold. Science and invention have relegated the crooked stick to the museum of antiquities, but until recent years the miner had to rely on his primitive horn spoon. The hardy prospector has been seriously handicapped in his search for the precious metals for want of a simple portable device for testing any and all kinds of rock where found. The pan and horn spoon answer when the metals are free and coarse grained, but are a delusion and a cheat where the ore is base. To meet this demand, Henry E. Way has invented a 'pocket smelter'. The original aim of the inventor was simply to enable the miner and prospector to tell whether their rock contained any metal at all, and if worth while to assay or not; but the uses of the little smelters have grown from year to year and other devices have been added.

The original pocket smelter outfit consisted of mortars and pestles and smelter tablets; later a patent acid-dropping bottle and case were devised, which, with a little 40-mesh wire screen substituted for the acid bottle and case, comprises what is now known as the 'little junior' outfit. All the manufacturers claim for this is a test for the presence or absence of metals. The demand for an outfit which would enable the various metals to be detected and identified, led the manufacturers to add a magnet, magnifying glass, patent acid-dropping bottle and case, and some minor articles, which constitutes what is known as the 'senior outfit'. With this a true qualitative analysis can be made on any ore of commercial value.

The addition of these articles made the outfit difficult to carry around in the pocket, which led the manufacturers to supply a leather-bound shipping and carrying case, in which every article fits so snugly that the omission of a single piece is at once noticed. A batea was provided for panning, and a rubber cloth for holding screened ore-pulp. The further demand for an outfit to extract and identify such rare minerals as tungsten, as well as for estimating ton values in ores by comparison, has led the manufacturers to place on the market the 'complete outfit'. This includes two extra boxes of smelter tablets, a batea in which to pan, with glass mortar, a number of assayed ore samples with ton values marked in dollars or per cent total, to serve as a 'comparison scale' in estimating values, together with an extra acid bottle and case, making two in all, by the combination of which aqua regia is formed, for use in the platinum and tungsten tests. This complete outfit is designed for the student, professor, mine owner, mine superintendent, and all desiring the maximum results at the minimum cost, and is for use in office, laboratory, and in the field. It is always ready for use in a moment.

The success of the 'pocket smelter' has been phenomenal, and it has steadily grown in favor with all classes. The limit of the utility and possibilities has not yet been reached. The original patent was for a device, but this has been elaborated and perfected until today it has become a combination of devices and parts, which will hereafter be designated as 'Way's process', to distinguish it from the blowpipe method, wet determinations, and assaying. The manufacturers make no false claims for Way's process, but guarantee results when instructions are strictly followed. It combines the good points of the blowpipe, wet methods, and the assay, in so far as they are practical on metals of commercial importance, without any of their imperfections. Quantitative determinations are left to those whose skill and technical knowledge of mineralogy and metallurgy peculiarly fit them for this work. Way's process, however, is being used for confirmatory tests, in connection with blowpipe, wet methods, and even assaying, and being so simple, inexpensive, and effective, the manufacturers confidently expect to eventually supplant all other methods except that of assaying. This useful outfit is made by Way's Pocket Smelter Co., of South Pasadena, California.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

PAVING BRICK AND PAVING BRICK CLAYS OF ILLINOIS. By C. W. Rolfe, R. C. Purdy, A. N. Talbot, and I. O. Baker. Illinois State Geological Survey, Bull. 9, 8vo., pp. 316, Ill., Index. Urbana, 1909. Postage 13 cents.

This report includes a discussion of the geology of clays in general, and of the paving brick materials of the State; of the qualities of high-grade paving brick, and of the tests used in determining them; of the qualities of clays suitable for making paving brick, and the pyrochemical and physical properties of paving brick clays; tests of the clays now in use and of the construction and care of brick pavement. The report is based on elaborate studies and is authoritative.

RESULTS OF PURCHASING COAL UNDER GOVERNMENT SPECIFICATIONS. By John Shober Burrows; and BURNING SMALL SIZES OF ANTHRACITE FOR HEAT AND POWER PURPOSES. By Dwight T. Randall. Bulletin No. 378, U. S. Geological Survey, 1909.

ERADICATING PLAGUE FROM SAN FRANCISCO. Report of the Citizens' Health Committee. By F. M. Todd. 8vo., pp. 313, Ill. San Francisco, 1909.

PEAT DEPOSITS OF MAINE. By Edson S. Bastin and Chas. A. Davis. Bulletin No. 376, U. S. Geological Survey, 1909.

PROCEEDINGS IOWA ACADEMY OF SCIENCE for 1908. Edited by the Secretary. 8vo., pp. 187, Ill. Des Moines, 1908.

JOURNAL OF THE CHEMICAL, METALLURGICAL & MINING SOCIETY OF SOUTH AFRICA, February 1909.

INVESTIGATIONS RELATING TO COPPER IN 1908. By F. L. Ransome. U. S. Geological Survey, 1909.

PHILIPPINE JOURNAL OF SCIENCE, December 1908. Vol. 3, No. 6.

PROCEEDINGS OF THE ENGINEERS' CLUB OF PHILADELPHIA, Vol. 25, No. 4.

Commercial Paragraphs.

THE DENVER FIRE CLAY CO., Denver, announces that in the future it will carry a complete stock of assayers' and chemists' supplies in Salt Lake City, at 156 Southwest Temple street.

The MILL & SMELTER ENGINEERING CO. has been formed to conduct a general business in designing and equipping mining and metallurgical plants. F. W. Hopkins is the manager and P. E. Van Saun is chief engineer. The office of the new concern is at 114 Liberty street, New York.

Catalogues Received.

THE TOLEDO PIPE THREADING MACHINE CO., Toledo, Ohio, has recently published an attractive catalogue describing its line of pipe-threading apparatus.

The SCHUTTE & KOERTING CO., Philadelphia, is distributing a pamphlet called Section B of Catalogue 5, in which the multi-jet eductor condenser is described.

The BROWNE & SHARP MFG. CO., Providence, R. I., has just published a new edition of its general catalogue. Special attention is called to the new machines, attachments, and small tools recently added to the line already carried by this well known house.

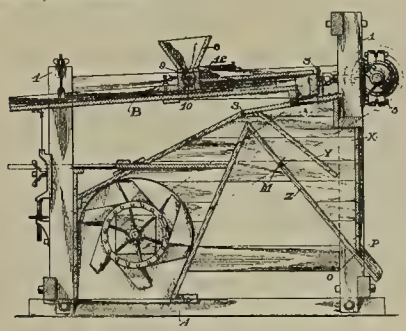
The WESTERN ELECTRICAL INSTRUMENT CO., Newark, N. J., is distributing some novel private mailing cards giving lectures on 'Economics', 'Electricity', 'Mechanics', 'Logic', 'Physics', and 'Chemistry'. The company styles itself a 'Correspondence Institute' and gives its agents as 'Local Associate Instructors'.

MINING AND METALLURGICAL PATENTS.

ELECTRICAL SHOT-FIRING MACHINE FOR MINES.—No. 916,476. Walter B. McLarty, Wilburton, Oklahoma.

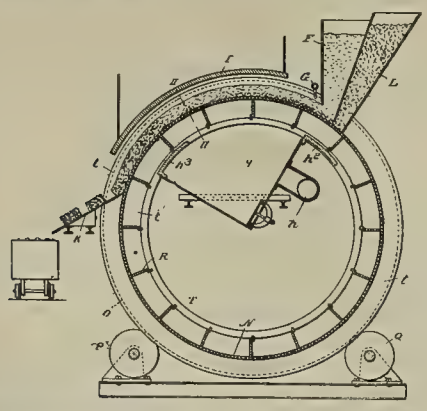
An electric shot firing apparatus for mines, comprising a generator, a rotatable controller arm, circuit closers mounted upon said arm, means for operating the latter, a conductor ring against which one of said closers is constantly in contact, electrical connections between said conductor ring and source of energy, a series of contact points against which the circuit closers upon said arm are adapted to contact at predetermined moments, electrical connections between said contact points, the source of energy and the charges to be fired, and an electric signal in the circuit with said ring, as set forth.

ORE-CONCENTRATOR.—No. 916,257. Samuel K. Behrend, Denver, Colorado.



In an ore concentrator the combination with a table, and means for reciprocating said table, of a hopper located at or near the middle of the table, a recessed roller in the bottom of said hopper, a shaft on which the roller is mounted, a ratchet wheel on the shaft, pawls engaging the ratchet wheel whereby the roller is intermittently rotated, a frame-work beneath the table in which the tailings are discharged through an opening at the upper end of the table, said frame-work having a constricted passage and two inclines leading from said passage, the space between the inclines being greater at the outer ends and one of the said inclines being longer than the other, and a suction fan beyond the constricted passage for creating suction of air.

APPARATUS FOR ROASTING AND SINTERING ORES.—No. 916,394. Arthur S. Dwight, Joliet, Illinois, and Richard L. Lloyd, New York.



In an apparatus for roasting and sintering ore, the combination of an endless ore support or carrier, having its successive ore-receiving sections rigidly secured together and all said sections being adapted to simultaneously move through a predetermined path, means for moving the said support, means for supplying air to permit it to pass through the ore mass in a direction transverse to the movement of the support, substantially as set forth.

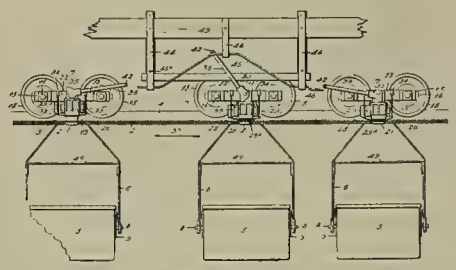
PRODUCTION OF SILICON.—No. 916,793. George O. Seward, East Orange, New Jersey, and Franz von Kügelgen, Holcombs Rock, Virginia.

The process of producing silicon by subjecting a suitable silicon compound and a carbonaceous reducing agent in an electric furnace to a temperature above that at which silicon carbide remains stable, thereby reducing the silicon compound and forming silicon vapor, while maintaining around or above the zone of reduction a cooler zone containing a non-oxidizing atmosphere in which the silicon vapor is condensed.

PULP-SCREEN-PLATE FASTENER.—No. 918,261. Eugene A. Bayley, Dexter, New York.

The combination of a pulp screen frame having cross braces provided with longitudinal passages, dovetailed bushings within the passages and near one end thereof, threaded elements engaging the bushings to adjust the same, screens having beveled edges upon the cross braces, slidable beveled locking bars having dovetailed fingers upon the cross bars, said locking bars having their sides engaging the beveled edges of the screens and the dovetailed fingers adapted to be positioned within the passages of the cross bars, and a threaded element engaging one end of the locking bar to force the fingers thereof into engagement with the dovetailed bushings.

TRACTION-ROPE-GRIPPING DEVICE FOR AERIAL WIRE-ROPE TRAMWAY BUCKETS.—No. 915,104. James H. Montgomery, Denver, Colorado.



In a rope gripping device for the buckets of aerial wire rope tramways, the combination with a stationary and a running rope, of an operative tramway bucket, a fixed jaw connected to said bucket and arranged to register with the under side of said traction rope, a non-rotatable but slidable movable jaw mounted on said fixed jaw to register with the upper side of said traction rope, a cam arranged to move said movable jaw to grip said running rope between itself and said fixed jaw, resilient means for normally holding said movable jaw away from said running rope when said cam is in a position of disuse, and means including angular slideways for automatically moving said cam to attach said jaws to or to release them from said running rope.

FLUID-OPERATED DRILL-SHARPENER.—No. 917,777. John G. Leyner, Denver, Colorado.

In a drill sharpener, the combination with a supporting base, a cylinder provided with a drill supporting arm, a yoke-shaped standard on said cylinder, a die at the upper end of said standard, a fluid controlled piston reciprocally mounted in said cylinder having a vertical stem, and a die in the end of the stem, said dies being formed with a combined drill-bit shank gripping portion and a conical diverging tapering portion adapted to form an enlarged tapering head portion on drill-bits, an arm on said cylinder, a hammer piston and cylinder mounted on said arm, drill sharpening dolly reciprocally mounted to project into said cylinder in the reciprocal path of said piston, and arranged to face the conical end portion of said drill bit gripping dies, a valve chest on the cylinder, a system of fluid ports extending from said valve chest to said cylinder and dolly operating hammer piston cylinder, and a manually operated valve in said valve chest arranged to control the ports leading to said cylinders.

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EDITORIAL.

BUENOS AYRES is to have an exposition extending from May to November next year in celebration of the centennial of the independence of the Argentine Republic. It should afford an excellent opportunity for North Americans to come into closer touch with our vigorous neighbor in the south.

PIPE LINES for carrying oil are exceedingly efficient means of transportation, but expensive to build. The directors of the Associated Oil Company have just authorized a bond issue of $25,000,000, of which $6,000,000 is to be expended in the construction of a new line from Coalinga to San Francisco bay, and of another from McKittrick across the mountains to Gaviota, on the Santa Barbara coast.

SOLLAR is a term applied in Australia to shovel-boards. It is also widely used to designate any platform or resting place, particularly between levels in a shaft or in a ladder-way. The term is derived from middle English, but really goes back to the Latin *solarium*, a sunny place, originally an open gallery or balcony at the top of the house, exposed to the sun. Thus the same root-word that served the Roman taking his ease at home does duty for the Cornish miner resting in his climb up the shaft at the end of his day's work.

NEVADA COUNTY, long the banner district in the California gold belt, is once more dazzling the world with a phenomenal discovery of bonanza ore. Within three weeks the Sixteen to One mine is said to have produced $400,000 in bullion. Rich shoots of ore have always been characteristic of the veins in the California slates, and in some cases the ore has continued to great depths, as in the Grass Valley mine, which is producing rich ore from 5000 feet below the outcrop. The recent discovery will attract deserved attention to this famous old county.

WITH THE COMPLETION June 26 of the period of mourning for the late Emperor and Empress Dowager of China, the Imperial Mints will resume work coining taels and the new dollars and fractional coins recently ordered. It is estimated the nineteen Mints will be kept busy for ten years to supply the coin already ordered by the Imperial Board of Commissioners of Finance and Commerce. The introduction of a national currency will be a more radical step than is generally appreciated, and will be highly experimental. At present each province issues its own coin, and inter-provincial exchange is hindered by the very general distrust of coins not locally current. Suspicion of the general Government is even more common. If the proposed Imperial coinage be successfully established it will

promote solidarity more, perhaps, than any other reform yet effected. Incidentally, a considerably increased demand for silver should result.

SWINDLERS find new opportunities every day. Even the Geological Survey occasionally suffers. The latest scheme was unearthed recently in Oakland, where a D. P. Coble has been sentenced for pretending to engage men for the Alaskan service. By means of a forged letter of authorization, he engaged some thirty men at "$60 a month and found," going so far as to engage steamship berths to lend color to the scheme. Of course a deposit was required to guarantee that each man hired would work throughout the season. Fortunately, before the money was paid over the scheme was exposed, the wiley schemer was arrested, and, after a prompt trial was given a sentence of eighteen months imprisonment. It may be a safeguard to remember that, in the words of the Director: "No person has ever been authorized to demand or receive money or any other consideration or promise, beyond that of faithful discharge of duty, from individuals seeking employment with the United States Geological Survey."

FERDINAND ZIRKEL has retired from the professorship of mineralogy and petrography after forty years of service. Beginning systematic work in petrography before the French had developed the principles of optical mineralogy, Zirkel's work goes back to the days of empirical observation. With singular generosity Zirkel extended to the younger Rosenbush a royal welcome when he worked out and applied the newer methods. To Americans, other than those who were Zirkel's students, he is well known through his writings. His volume on the microscopical petrography of the rocks collected by the Geological Survey of the Fortieth Parallel, contains the first exact description of the rocks of the Comstock lode. While the methods then available were crude and the difficulties which caused trouble were pathetic, the book will stand always as a monument, not only to the liberal attitude of Clarence King, but also to Professor Zirkel. To him in his retirement many American friends and admirers will extend greeting and good wishes.

RESERVOIR SITES in the western mountains are in demand. Mr. J. R. Garfield, while Secretary of the Interior, withdrew from entry considerable areas supposed to be suitable for this purpose. One of the first acts of the new Secretary, Mr. Richard A. Ballinger, was to throw these lands open to entry. Now at the direct instigation, it is stated, of Mr. Taft, the lands are a second time withdrawn, and the Geological Survey and Reclamation Service are ordered to make an examination to determine their exact character and value. It is well known that Mr. Roosevelt and his advisers perceived the danger of all such sites falling into the hands of a single company which would hold a monopoly of hydroelectric power throughout the West. It was this which led to the original withdrawal of the lands. The action of Mr. Taft in directing that they be again withdrawn and examined is significant of his probable attitude toward such problems. It seems likely, however, that after the investigation is made the results will be transmitted to Congress, and the responsibility for action or inaction laid upon the legislative body, where it belongs.

Financial Prospects.

Wall Street's activity has set the wiseacres analyzing. They are trying to find a reason for the prevailing optimism. Even during the uncertainties of pending tariff revision a general strengthening of tone has been noted in the market. The Steel Corporation's report undoubtedly had much to do with this. While by maintaining prices without fixing them for a definite period the Corporation checked normal development, large production has been called for, aside from deliveries under old contracts, through the demand arising from repairs, maintenance, and necessary amelioration. In so complex a civilization as ours these constitute basis enough for a large volume of business. The common stock of the Steel Corporation is manifestly nearer important participation in earnings than ever before. This is due to the fact that the huge Gary plant has been built out of current profits, no bonds having been issued to make provision for the greatest output of steel the world has ever seen, at costs lower than ever before realized in this country or in Germany. Success gives contagion of hope. The spectacle of a corporation thriving despite hard times is exhilarating. Unfortunately, the other metals are not sharing this prosperity. Securities, however, have held their own. The spirit of optimism is in the air, and is making itself felt in a material way. The market revival is not a product of the 'boosters'. There is work in progress, and the Italian *padrone* has kept his watchful eye upon it and is bringing in workmen to meet this demand. We have come to regard the immigration statistics as another 'barometer' of trade, and a most mercurial one at that. The Italian peasant evidently keeps on hand a sum sufficient to return to the land of cheap macaroni and wine at the first sign of starvation here. His industrial generalship is distinguished by adherence to the time-honored wisdom of keeping open his line of retreat. The flight of the mis-named 'Diegos' was a conspicuous feature of the spring months of 1907. The merchants and manufacturers became suspicious of impending disaster only late in the summer. Now the tide has turned. Not only were there 113,038 arrivals in March, but the emigration for that month was below the normal. These are conclusive proofs that labor is in demand, and clearly indicates returning industrial activity. There has been a shrinkage of both exports and imports in nearly all the countries of the world, except France, which seems to have an irrepressible financial vitality. The reduction, however, is in the value, rather than in the amount of the commodities themselves. This renders deduction as to future probabilities less easy. The movement of raw material continues in a volume indicative of anticipated demand for manufactures on a normal basis. The prices of agricultural products have not receded from their former high level, and there has been a

notable increase in the price of grains. But little overproduction has taken place in any quarter, and a decided turn in the course of business, with the inauguration of new enterprises, would absorb the excess of metals now in store within so short a period as to cause immediate improvement in quotations. The existence of enormous quantities of idle money, as reflected in the low rates prevailing on both sides of the Atlantic, has already caused a movement toward new industrial investments. For a time fresh bond issues could lap up the surplus, these being largely issued to replace maturing short-time notes given by the railroads. New bonds are still welcome, but the tendency to reach into more speculative fields is manifest. We have already pointed out the readiness with which copper properties find a market, and the same is true regarding many other mineral deposits. Probably as many mines, which have reasonable expectation of success, have been floated during the last six months as during the same period in 1906. At bottom the demand for the product of the miner is one of the truest indicators of financial health.

Smelter Smoke.

For the sake of everyone to whom the continuance of operations at the Washoe smelter is of vital moment, we rejoice in the dismissal of the suit by Judge Hunt, putting an end to the famous litigation between the farmers of Deer Lodge valley and the Anaconda Copper Company. The suit is dismissed without prejudice to any action for damages on the part of the complainants. The Court found that the smelting company had applied nearly every remedy for the smoke-nuisance that offered hope of relief. On the legal side, the termination of the controversy creates an additional precedent sustaining public as against private right. The Western courts are divided on this question, and the conflicting judicial opinions are a detriment to normal development. A Supreme Court decision in a case involving this principle would be a distinct advantage. In the semi-arid regions the first call to the agriculturist has been the need of the mining community. The Far West has become more important for its agricultural than for its mineral resources, but it will be found that nearly every centre of such development has a mining enterprise as its nucleus.

Douglas, Arizona, affords a most interesting illustration of the way in which smelting has altered conditions so as to make them favor agriculture. Prior to the commencement of smelting there, farming had been impossible because of the wide range in temperature, the average diurnal variation being from a maximum of 92.6 to a minimum of 28.4, a change from day to night of 64.2 degrees Fahrenheit. Under such conditions plant life was limited to those desert orders which in the course of ages had developed resistance to such climatic severity. On the advent of the smelter, however, a pall of smoke was spread over the valley, serving as a reflector retaining the heat absorbed by the earth during the day, and reducing the range of variation to less than 30 degrees. The rich soil and abundant water of the valley invited agriculture, which has grown to large proportions. It is a unique situation, for the farmer must accept whatever comes, sulphuric anhydride, arsenic, and the rest; an injunction shutting off the smoke would literally freeze him out. The case is also interesting as showing how agriculture follows the market created by the mineral industry, even when the possibility of growing crops depends absolutely upon the physical effect proceeding from the continuous operation of a smelting enterprise.

An Undemonstrated Process.

Ten years ago a group of financiers purchased the Santa Rita copper mines in New Mexico from Mrs. Phoebe A. Hearst for $1,400,000 cash. This group included Albert C. Burrage, William Rockefeller, H. H. Rogers, Albert S. Bigelow, and Thomas W. Lawson. The property in question is extensive and shows copper at many points, but no high-grade orebodies of sufficient size to warrant important operations by the usual methods have been found. It is now being exploited by Mr. Lawson, who has resorted to the last expedient of the sharper—he now appears in the rôle of a new-process man. He claims to have participated in the invention of a wonderful process which is to save all the copper in the ore. In a remarkable volume of 250 pages he sets forth the disadvantages under which copper metallurgy is laboring, and calls attention to the losses, which he states at one-third of the original metal in the ore. If the losses in handling, concentration, and smelting be all included, the average would probably reach that amount. The largest occurs in the concentration. From twenty to thirty per cent of the metallic content is lost in that operation. The enormity of this well recognized defect in modern methods is impressively announced, and then follows the statement that the great problem has been solved. Mr. Lawson affirms that the new process is at work commercially, but that "the world at large knows nothing of its existence." He even prophesies disaster for other copper producers so dire that the wonder is that a syndicate has not been formed to buy him out. The "readjustment of values in $1,500,000,000 of copper securities" by reason of this revolutionary process is too stupendous—to be believed! Only the lesser troubles in life awaken anxiety and distress. Man is so constituted that he can face the really great calamities, even such as Lawson, with equanimity.

Part of the Lawsonian game consists in unexpected alliances. Certain recent flotations won because of great names in which the public had confidence. In this case the inventor of the new process is said to be Mr. Charles S. Bradley, the man who developed the first successful method for the production of aluminum. But there was no mystery hovering over those earlier efforts. The discovery was explained so that its details were understood by technical men. In the present case all the marks of the charlatan and humbug are present; there is a plant supposed to be in operation on a commercial scale, and the public is offered bonds convertible into stock; the process is supposed to be ready for installation in Grant county, New Mexico; and yet not one hint is given of the method pursued or the solvent used. This is the

same appeal to blind unquestioning faith that the new-process faker ever makes. 'You see me put in this ore; you see me take out this metal; what more do you need?' It recalls Wynn at Denver in 1901, with his use of Teller and Holdrege to give respectability to a wonderful secret process by which 'fine gold' was to be saved in quantity. Beam, Gage, Jernigan, and a host of names of similar inventors, come at once to mind.

But seriously, wonderful as are modern inventions, we are not in the Middle Ages, and it is no longer necessary for cunning craftsmen to guard trade secrets. These are the days when the great work of the world is done out in the open, under protection of law; when the light of science is turned upon the pretensions of discoveries; and he who slinks in darkness, evading investigation, however he may brag, may be considered to have found nothing that will bear the scrutiny of competent men.

Transportation and the Far East.

Adequate transportation is essential to commerce. No exchange of commodities can occur without means of shipment, and no steady trade can develop except where regular lines of transportation are available. Any complete system involves 'feeders', main-line haulage, and distributing lines. From the United States there are two routes; one by way of the Suez, and the other across the Pacific. The first has the advantage of dense local traffic but is long. The second has practically no local traffic but is short. The Suez route is cheaper, the trans-Pacific is quicker. Just how these advantages weigh against each other is shown by a recent shipment of mining machinery from Chicago to Siberia. The cost was approximately $50 per ton, of which $35 was absorbed by the rail-haul from Chicago to San Francisco. Similar machinery could have been sent from London by way of the Suez for $7 per ton, but its transportation would have required months longer. This being a 'rush order' went by the quicker though more expensive route. It must be clear that regular trade cannot be created against this handicap.

Cheap ocean traffic is carried by tramp steamers and by sail. These can, however, only be counted on where freight is abundant. Liners, sailing at an appointed time, whether loaded or empty, must be given some advantage if regular communication is to be established, and modern business more and more demands speedier dispatch. We prize regularity and promptness above mere cheapness. Indeed, for new trade they are essential. In the end they bring a recurrent cheapness.

The American railway system is a nearly perfect network of lines, well adapted to collect raw materials and manufactured articles and carry them to points of export. The weakness of the Western roads is in the relative absence of local traffic. They have been forced to offer exceptional rates for transcontinental and export freight in order to live. Except for it they could not furnish local communities with transportation on any terms. Up to a short time ago they quoted through rates to the Orient in competition with the Suez route, making a division of rate with associated steamer lines which were under contract for regular sailings. In view of certain rulings of the Interstate Commerce Commission these tariffs have been withdrawn, and local rates to the Coast must now be paid. The result has been the withdrawal of ships and a heavy falling off in trade.

There are now eight lines carrying freight from Shanghai to American Pacific ports: two American, two American-owned but sailing under the British flag and carrying freight only, two Japanese, one Canadian, and one French line which carries freight only and sails from Europe to Asia and America on around-the-world trips. The trans-Pacific service is not only inadequate, but is largely foreign-owned. In addition, the distributing system of coastwise vessels and railway lines in the Orient is necessarily, and properly, foreign-owned. How important these lines are becoming is feebly appreciated. China is using the revenue from her existing railways to build new lines, and under competent native engineers, Chan Tien-yu, Yen Te-Cheng, and others, is making excellent progress. The Pekin-Kalgan line has been built through the most difficult pass, and by the end of the year will be completed. Surveys to the Siberian border are being made, and it is estimated that within six years the line will furnish not only direct communication between China and Mongolia, but a short-cut from Irkutsk to Pekin. In the meantime the Japanese have re-built the South Manchurian railway, and with a full equipment of Pullman cars, and direct connection with the Chinese Eastern road at Changchun, it affords quick transit to Europe. The light railway built during the war from Antung to Mukden is being reconstructed, and will furnish within three years an adequate connection between the Korean and the Manchurian lines. Everywhere in the Orient railways and steamer lines are being established, and only in the Philippines do Americans take any part, though there is a temple in China dedicated to the memory of 'Ward the American' who not only put down the Taeping rebellion but also introduced over 100 American steamboats on the rivers of that country.

The opportunities in America for the use of capital, and the profits from local industries, are even yet so large that ship-building and operation, foreign railways and foreign concessions, have not been attractive to American investors. From a cold business standpoint there is no more direct profit to a rich and busy people in carrying their own exports to market than to a busy millionaire laboriously carrying his own trunk to the train. There might, however, be considerable indirect profit to either. It is possible that the millionaire might find it to his advantage to maintain at some loss a private baggage van, if it were necessary in order to assure prompt and satisfactory delivery of his baggage, and Americans may find it necessary by some means to control more lines of transportation to the Orient, if the full advantage of our short western route is to be realized. Custom tariffs are not the only means of discrimination, as the Mexican railways have recently shown.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

D. C. Jackling is at New York.

Robert W. Jones is in Colombia.

Lewis T. Wright has left for London.

H. W. Turner has been in Salt Lake City.

Francis N. Flynn is at Humboldt, Arizona.

E. H. Garthwaite has arrived from Salvador.

J. H. Mackenzie leaves for New York on May 22.

Richard A. Parker is on his way to eastern Sonora.

Colin McIntosh has returned to Salt Lake City, Utah.

N. S. Kelsey will leave San Francisco for Alaska, May 22.

F. G. Clapp is examining oil and gas territory in the East.

Ralph Arnold has returned to California from Washington, D. C.

Frank Klepetko has moved his office to 42 Broadway, New York.

Edmund B. Kirby has returned to St. Louis from Goldfield, Nevada.

John March, of the New Departure Mines, has returned to Dillon, Montana.

J. W. Bryant, of the Tyee Copper Co., has returned to Victoria from Mexico.

R. H. Toll is at Mancos, Colorado, examining properties in the La Plata mountains.

A. Roy Heise has accepted a position with the Llanos Consolidated Co., at Boluda, Sonora.

J. M. Ruffner, manager for the North Columbia Gold Mining Co., in the Atlin, B. C., district, has gone north for the season.

C. W. Purington sailed for Japan Thursday. His address for the summer will be, Care Russo-Chinese Bank, Nikolaievsk, East Siberia.

George E. Driscoll, lately with the New York & Honduras Rosario Mining Co., will open an office at Sabana Grande, Honduras, Central America.

Arthur S. Dwight is consulting engineer for the Humboldt smelter, in Arizona. He is now at Humboldt, elaborating plans for resumption of operations.

W. H. Staver, of Hemet, Cal., who recently had his arm broken in a runaway accident, is convalescent, and is studying the gem-formations of Riverside county.

Percy E. Barbour has resigned the management of the Promontorios Mines, in Mexico, and has no connection whatever with the Clark Copper Co., which owns that property.

John M. Nicol, until recently manager of the hydraulic department of the Joshua Hendy Iron Works, is consulting engineer to the Trinity River Mining Co., and is installing a new plant for them.

Sidney B. Williamson, Chief Division Engineer, Pacific Division, Panama Canal, is studying placer mining methods in Trinity county and southern Oregon, in company with John M. Nicol, with a view to adopting this system of excavation for a section of the canal.

Assignments to Alaska for the present season's work of the United States Geological Survey are as follows: A. H. Brooks will remain in general charge and expects to make a personal trip from the Copper river to the Yukon and down to Nome. R. H. Sargent will have general charge of the topographic work and will make a detailed map of the Matanuska coalfield. P. S. Smith will make a reconnaissance from Nulato to the Seward Peninsula. L. M. Prindle will make surveys in the Yukon-Tanana region. F. H. Moffat and S. R. Capps will work in the Copper River district. Adolph Knopf will study the Berners Bay region. U. S. Grant will study certain portions of the Kenai peninsula. G. C. Martin and D. C. Witherspoon will make a reconnaissance from Cook Inlet to Lake Iliamna. A. G. Maddern will study the Coldfoot district on the Koyukuk.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, May 13.

Antimony	12—12¼c	Quicksilver (flask)	44—45
Electrolytic Copper	15¼—16½c	Spelter	6¼—7c
Pig Lead	4.55—5.50c	Tin	32—33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 6. £ s. d.	May 13. £ s. d.	
Camp Bird	1 3 0	1 1 6	ex div.
El Oro	1 6 0	1 6 9	
Esperanza	2 16 0	2 17 0	
Dolores	1 10 0	1 10 0	
Oroville Dredging	0 10 9	0 11 0	
Mexico Mines	4 11 3	5 12 6	
Tomboy	1 1 3	1 1 3	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 7	12.63	4.23	5.05	53½
" 8	12.69	4.25	5.05	53⅛
" 9	Sunday.	No market		
" 10	12 75	4.25	5.05	53
" 11	12 87	4.27	5 05	53⅛
" 12	12.94	4.27	5.05	52½
" 13	12 94	4.30	5.05	52¾

MINING QUOTATIONS—NEW YORK.

	Closing Prices. May 6.	May 13.
Amalgamated Copper	80⅜	82⅞
American Smelting & Refining Co	93¼	93
Boston Copper	14¾	14¾
Butte Coalition	26½	25¾
Cumberland-Ely	7½	8¼
Dolores	5	5
El Rayo	2⅝	2⅝
Giroux	7⅞	8
Greene-Cananea	10⅜	10⅞
Indiana Sonora	3⅛	3¼
La Rose	7	7⅛
Miami Copper	15¼	15⅜
Nevada Consolidated	20⅞	22⅜
Newhouse	2⅜	2¾
Nipissing	10¼	10½
Ohio Copper	6⅛	6⅞
Tennessee Copper	42⅛	43¾
Utah Copper	49¼	51¼
Yukon	4⅛	4⅜

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. May 13.		Closing Prices. May 13.
Adventure	8¾	Mass	14½
Ahmeek	150	Mohawk	64
Allouez	40	North Butte	60½
Arcadian	5½	Old Dominion	54¾
Atlantic	15¼	Osceola	134½
Calumet & Arizona	103½	Parrot	34½
Calumet & Hecla	655	Santa Fe	2⅝
Centennial	32	Shannon	15½
Copper Range	79½	Superior & Pittsburg	14¾
Daly-West	9¾	Tamarack	72
First National	6⅛	Trinity	14
Franklin	15¼	United Copper Con	13¼
Granby	103	Utah Con	41½
Greene-Cananea, ctf	11	Victoria	5¼
Isle Royale	27¾	Winona	5½
La Salle	14¼	Wolverine	148

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, May 13.

Atlanta	$ 15	Mayflower	$ 10
Belmont	91	Midway	24
Booth	18	Montana Tonopah	79
Columbia Mtn	14	Nevada Hills	1.30
Combination Fraction	90	Ophir (Comstock)	1.35
Daisy	34	Pittsburg Silver Peak	45
Fairview Eagle	18	Rawhide Coalition	30
Florence	3.12	Rawhide Queen	34
Goldfield Con	7.87	Round Mountain	80
Gold Kewenas	15	Sandstorm	14
Great Bend	14	Silver Pick	19
Jim Butler	15	St. Ives	10
Jumbo Extension	14	Tonopah Extension	66
Llanos Con	73	Tonopah of Nevada	7.00
MacNamara	24	West End	29

General Mining News.

ALASKA.

(Special Correspondence).—A 3-stamp mill has been started at Fairbanks with the aid of brass bands and much enthusiasm. It is a home-made affair, built by Brumbaugh, Hamilton & Kellogg, and designed to treat the quartz ores of the Tanana valley. To this mill Lucien B. Rhoads and W. C. Hall have sent a 1740-lb. sample of the ore from their Free Gold quartz claim, and in 10 hr. a yield of $137 was obtained with no further saving apparatus than a short length copper amalgamating plate. Rhoads and Hall located this claim last September on Bedrock creek, a tributary of Cleary creek, and sunk a shaft 50 ft. deep on four small stringers which lie within a few feet of each other. Trenches have exposed the veins on the surface for something over 300 feet.

Fairbanks, April 16.

ARIZONA.

COCHISE COUNTY.

The Copper Queen is now shipping 35 cars of ore to its smelter at Douglas and four cars of sulphides to the Old Dominion at Globe. These sulphides are obtained from the Holbrook shaft and run 45% sulphur. All the ore from the Copper Queen properties, with the exception of the Lowell, is now being handled through the Sacramento shaft.——The April output of the Calumet & Arizona and Superior & Pittsburg will be slightly less than that of last month, which was 4,500,000 lb.——The Junction property of the Superior & Pittsburg is shipping an average of 16 cars a week, the Hoatson 48, and the Cole 36, a total of 100 cars, or about 4500 tons, weekly. The recent strike at the Junction on the 1200-ft. level has shown up at present about fifty feet of oxides, assaying between 5 and 7% copper. The sulphide body in the southwest drift on the 1400-ft. level continues to average 15% copper.——The Wolverine & Arizona, for the first time in its five years of existence, has made a shipment, which consisted of 500 tons of oxide ore averaging 11% copper, which included about all the ore on the dump which has been extracted during the process of development work.

GILA COUNTY.

J. J. Shaw, manager for the Mazatzal Copper Co., reports the new adit to be in about 225 ft. and expects to reach the vein in about 25 ft. more. The company owns about 700 acres altogether, with the mines about 9 miles from Payson, which is 80 miles northwest of Globe, the nearest railroad point.——News from the Inspiration Copper Mine property states that the sulphide orebody is developing very well. In the shaft 800 ft. from the Miami lines, between the depth of 100 and 125 ft. the ore averages 2½% copper.

A branch of the American Mining Congress has been formed in Globe, under the presidency of J. D. Coplen, to stimulate legitimate mining in the district and to prevent exploitation by fraudulent promoters. The other officers of the local branch are F. A. Woodward, M. C. McCarthy, Louis A. Wright, A. G. Smith, and J. K. Satchell.

MOHAVE COUNTY.

Great activity prevails in the San Francisco range, bordering the Colorado river between Eldorado canyon and Parker, in Yuma county. About midway along this range is the Goldroad mine, where quantities of $10 ore are blocked out. The company is erecting a 60-stamp mill, and expects to have it ready by July 15. The power line from the Desert Power Co.'s station in Kingman to Goldroad, a distance of 25 miles, is now being constructed. At the Tom Reed mine, near the Goldroad, a 10-stamp mill is being erected and will use the same power line. The company is at present running the old 10-stamp mill, and is reported to be working on a 20-ft. vein of $50 ore.——Three miles from Kingman the Bimetallic Gold Mines Co. is developing a property formerly known as the McGuire mine. It consists of a lava-capped hill with a vein carrying free gold worth about $8 per ton. A 10-stamp mill, with concentrators, has been installed, and has now been in operation for three months. Further additions to the present plant are intended.——The Expansion Mining Co. was organized about a year ago, by Charles J. Hutchinson of Seattle, Wash., and is operating a mine at Union Pass, 25 miles west of Kingman. A shaft 170 ft. deep has struck good ore, and the company is now intending to put up a stamp-mill.

YAVAPAI COUNTY.

The Yavapai Mining & Development Co. has just completed a well nearly 2000 ft. deep at Del Rio, prospecting for oil. At a depth of 1888 ft. oil-sand was struck, which proved to have a thickness of 90 ft. The sand is thoroughly saturated with oil which is pronounced by experts to be a high-grade paraffine oil. Another well is to be started at once, according to J. A. Gilbert, secretary and director of the company.

CALIFORNIA.

AMADOR COUNTY.

(Special Correspondence).—Owing to a disagreement between the operators and miners over the new eight-hour law, the men employed at the Argonaut and Zella mines at Jackson, the Bunker Hill and Fremont at Amador City, and the Campo Seco mines and smelter at Campo Seco have gone on strike. The men demand that eight hours shall include the time of going and coming to work, while the operators insist that eight hours of actual work must be performed. The Argonaut employs 150 men, the Zella 130, the Bunker Hill and Fremont 300, and the Campo Seco 100. The Kennedy is unaffected at present. The management of the Campo Seco properties announces that only enough ore is on hand to run the smelter about three days, and that if the men do not return to work before this time the smelter and mine will be permanently closed down. It is stated the company has not been making more than expenses for several months and will not stand for a reduction of working time. This will throw out the 150 men employed on the surface. A conference will probably be held soon, as the miners have named a committee to meet the operators of the various properties affected.——Operations have been resumed at the Keystone mine with a small crew. The mine has been unwatered and work will be done in the lower workings. J. McDonald is in charge.——A cyanide plant is being installed at the Defender.——The Hambric lease on Amador Queen shipped 1200 lb. of ore last week to the Selby smelter. The shipment was valued at $1200.——The damage recently done to the shaft at the Kennedy by a runaway load of timbers has been repaired and all the men are back at work. The mill has been idle for several days as a result of the exhaustion of ore supply.

Jackson, May 10.

CALAVERAS COUNTY.

S. R. Fox has leased the Hagerman gravel mine, situated about three miles north of San Andreas, and will test the ground to ascertain if he can work it by dredging.——W. H. Brown and associates have a two-year bond on the Early Bird property, which they have been operating during the past two months. The 10-stamp mill is kept running steadily with a force of about twenty men on the pay-roll.

ELDORADO COUNTY.

The El Dorado-Placer Dredging Co. has been incorporated at Tucson, Arizona, to work the auriferous channels of the American river, which separates the counties of Placer and Eldorado. The directors include Henry Fuller, William J. Variel, M. E. Williams, B. F. Bledsoe, and others.

NEVADA COUNTY.

A scheme is being elaborated to renew work at the famous placers of North Bloomfield. Under the town lies a deposit that has never been worked, and which is believed to be just as valuable as most that has previously been turned over. Property owners are now willing to allow their houses to be undermined, and to receive a percentage of the profits obtained therefrom. The work of undermining can be done without inconvenience to the inhabitants.

PLUMAS COUNTY.

The Spring Garden tunnel of the Western Pacific railway, near Quincy, has been completed. It is 7000 ft. long, while

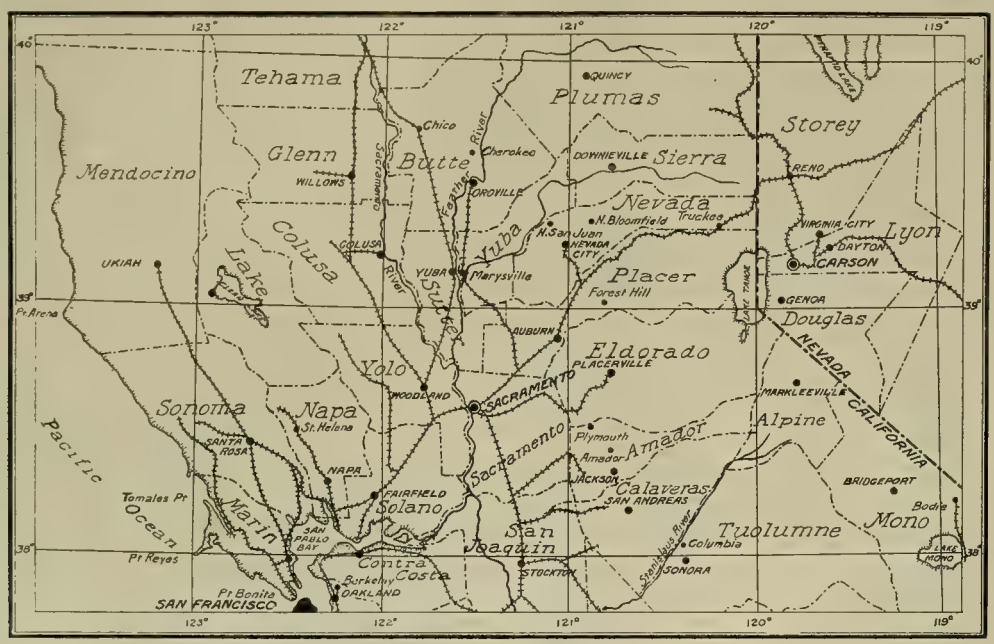
another, 6400 ft. long, known as the Chilcoot tunnel, is very nearly ready for the rails. The construction of this new road has required 45,525 ft. of tunnel in its total length of 927 miles, and has thereby enabled three mountain ranges to be crossed with a maximum gradient of 1%. The summit to be crossed by the new railroad is 2000 ft. lower than that by which the Southern Pacific crosses the Sierras, being only 5018 ft. at the Beckwith pass.

SANTA BARBARA COUNTY.

The Union Oil Co. has a dry well at Lompoc which is 4450 ft. deep. Another is being sunk at Rosemary on its Brashear lease, that is now 5117 ft. deep, with no indication of oil yet found. It is the deepest well in California, and one of the deepest in the world. The well has 12½-in. casing to 1048 ft., 10 to 2902, 8¼ to 3908, and 6⅝ to 5098. Sinking will continue as far as 6000 ft. if necessary, although work has been progressing continually for two years.

SHASTA COUNTY.

The Lucky Spot mine has been incorporated to work the old placer claim of that name, near Ingot, which was worked with much profit in the past. Work on this mine was delayed for many years, the property being in litigation. The courts decided recently in favor of the miners, against the Southern Pacific Co. Now that a favorable decision has been rendered, operations will begin at once.



Map of Central California.

SIERRA COUNTY.

The Sixteen-to-One mine, at Alleghany, continues to produce ore of phenomenal richness. It is indeed one of the most remarkable pockets ever discovered in the region, as ore to the value of fully $300,000 has now been obtained in a single drift 5 by 7 ft. in size, without any stoping. E. H. Wilson, the principal owner, has 10 men at work.

TRINITY COUNTY.

R. H. Elliott is engaged in prospecting an extensive area of gravel around Trinity Center, to ascertain if it is suitable for dredging. He will soon have a Keystone drill on the ground to accelerate his investigation.——At the Birdie M. mine H. S. Nonemaker has opened up a 3-ft. vein of rich ore, assaying high in gold and carrying some silver. The mine is situated in the New River mining district, about 1½ miles from Quimby postoffice.

TUOLUMNE COUNTY.

The Bagdad-Chase mine, near Soulsbyville, is employing about 50 men underground and on the surface. There are now 10 levels in the mine, with the lowest at 800 ft. Milling is effected by amalgamation and concentration, nearly 80% being saved by the former process. C. S. Verrill is manager and C. L. Pierce superintendent. The former will shortly leave for Boise, Idaho, to take charge of a mine.——Good development is being made at the Black Oak mine, which is about 1300 ft. deep. A total extraction of 96% is being made from the general run of ore, which varies between $6 and $15 per ton. The millman, S. A. Knapp, keeps 20 stamps at work all the time, and others when the ore supply admits. Roger C. Knox is general superintendent.——The Crystalline and Alabama mines, near the Harvard mine, at Jamestown, have been leased for some time to H. Leighton and V. Farmer, who have developed sufficient ore to start their mill. This will be done as soon as adequate water supply is available.——The Esmeralda and East Esmeralda mines, at Tuolumne, have recently been bonded by J. S. Gasper, George Medelin, and O. H. Green, who are advancing the adit along the vein, and are now in 175 feet.

YUBA COUNTY.

By the first of July an additional battery of 10 stamps will be installed in the mill of the California Mother Lode Mining Co., making 20 stamps in all. The plant will then be one of the biggest in the region. The development work has opened up sufficient ore to keep the 20 stamps dropping constantly. A day and night shift will be worked. The mill will then have a capacity of 100 tons per 24 hours. Walter de Varila is in charge of operations.

COLORADO.

EAGLE COUNTY.

The mill of the Eagle Mining & Milling Co., near Redcliff, designed to handle the low-grade ore of the Iron Mask mine, is rapidly nearing completion, and will, it is expected, be in operation by the first of June. The mill will have a capacity of 100 tons per day, the method adopted being concentration.——The new aerial tramway of the Rocky Point mine is now ready, and will transport about 50 tons per day to the shipping point. There are now 30 miners employed. The lessees, Dismant Bros., Little & Baldwin, have been experimenting on their low-grade ore to find an efficient method of milling.

EL PASO COUNTY.

The Golden Cycle Mining Co. has purchased the Pike's Peak Fuel Co., to the north of Colorado Springs. The com-

pany will begin at once to erect a power plant on the site of the Park View coal mine, and to furnish power for the company's mill at Colorado City. It is expected later to furnish coal for the Golden Cycle mine at Cripple Creek.

GILPIN COUNTY.

Two cars of concentrates have been loaded at the Rollinsville depot of the Moffat road for shipment to the Argo smelters, by the Perigo and Smuggler mills. Two carloads of machinery have also been received for the Tungsten Mining & Milling Co., which has been hauled to that camp for installation in the new mill.——A number of men are making preparations for working in Nevada gulch during the season when the water supply is plentiful, and several sluice-boxes are already in evidence.——The German Gold & Uranium Mining Co. has a force of 11 men at work in its German mine, in the Nevada district, and has begun to install its new steam engine in the shaft-house.——The gold production of Gilpin county in 1908 was nearly $1,100,000, or fifth in order of the gold producers of Colorado.

TELLER COUNTY.

The production of the Cripple Creek district for the month of April has totaled 59,700 tons, of the gross bullion value of $1,351,375. As compared with the preceding month there is a decrease of $31,145, due to the shorter month, and to the fact that returns could not be obtained from the new mill of the Stratton's Independence, in the absence of Philip Argall. This mill has so far only worked on a small scale, the nominal capacity being 300 tons per day.——Measurements taken by the engineer, T. R. Countryman, at the Cripple Creek Drainage tunnel show a total gain for the month of 986 ft., making an addition to the records in speed of driving already accomplished. The Portal heading was driven 316 ft., the north and south headings from the Intermediate shaft, 387 and 283 ft., respectively, giving a total distance driven to date of 8424 ft., or more than one-half required to tap the main vein on Beacon hill. In about six weeks connection will be made between the Intermediate shaft and the Portal.

An important discovery has been made on the 500-ft. level of the Gold Coin shaft of the Granite Gold Mining Co., situated within the city of Victor, by Richard Little and his associate lessees. By a cross-cut 300 ft. east of the main vein, a new orebody has been exposed, heretofore undeveloped. It has been named the 'Black Canon' lode by the superintendent, Dan McCarthy, on account of the dark color of the walls. Since the cessation of pumping operations at the Strong mine, the water in the Gold Coin shaft has risen to a point about 60 ft. above the station on the 1000-ft. level, submerging the station pump. All work in the mine is being done by lessees, there now being no men on company account.

IDAHO.

SHOSHONE COUNTY.

(Special Correspondence).—Decreases in profits ranging from 65% on the Hecla to 40% on the Federal properties are reported in statements by the various mining companies to the assessor of Shoshone county. In consequence of this decrease the assessed valuation will be reduced from $10,000,000 in 1908 to about $9,000,000 for this year. Several of the big producers were closed from two to five months in 1908. The Hecla was shut down about five months, the Last Chance almost three months, and the Tiger-Poorman and the Morning mines were closed for a longer period. The Tiger-Poorman showed a loss and was dismantled, while the Morning property was operated at a small net profit. The Bunker Hill & Sullivan Mining & Concentrating Co. reports net profits of $902,000, while the gross amount of ore taken from the mine was worth more than $3,000,000. The Hercules mine at Burke reports net profit as $383,000, and gross value of product as $1,195,000. For the Hecla Mining Co. the same items appear as $108,000 and $570,000 respectively. Net profits of other mines are as follows: Standard Mammoth at Mace, $693,000; Last Chance at Wardner, $221,000; Morning mine, $16,800; while the net loss of the Tiger-Poorman at Burke appears as $41,800. The decreases in the county's revenue will be made up this year by the advent of the Chicago, Milwaukee & Puget Sound, and the Idaho Northern railway companies, which will be assessed for the first time.

Wallace, May 8.

(Special Correspondence.)—At a special meeting of the stockholders of the Montana Standard Mining Co., just held in Wallace, it was agreed to increase the capital by $500,000, to purchase a mill for the mine. A large amount of ore has been blocked out and a number of shipments have already been made.——The long adit driven on the property of the Alma Mining Co., near Mullan, has encountered the vein, and about 12 ft. of low-grade ore has been exposed, the average value of which is between $5 and $6.——A strike of 5 ft. of clean shipping galena ore has been made on the property of the Orofino Mining Co., recently bonded by Patrick Burke of this city. The strike was made at a depth of 350 ft. In addition to the shipping ore, a large amount of milling ore has been exposed, the full extent of which has not yet been ascertained. The strike has created quite a little excitement in the Murray district.——Nearly $3000 has been promised by the business and mining men of the city of Wallace to provide a suitable ore display at the Alaska-Yukon-Pacific Exposition. The mine owners are doing everything possible to get up a display worthy of the region. At the same time, the Wallace Board of Trade will make a strong attempt to have visitors from the East pass through the Coeur d'Alene on their way to the Fair. ——The 6000-ft. adit which was started some time ago on the property of the Iron Mountain Mining Co. has now been completed, and Patrick McElmeel, the superintendent, is engaged in installing two boilers and a 15-drill Ingersoll-Rand compressor. The property was closed down some years ago by order of the State Mining Inspector on account of the fact that there was only one shaft, the law requiring two in case of accident. The ore will be mined through the long adit and treated in the same manner as in the other big mines of the district.——Arrangements are being made for a resumption of work at the Charles Dickens mine, on Moon creek. It is intended to sink about 300 ft. Arrangements have been made with the O. R. & N. company to construct a spur to the mouth of Moon creek, and when this is done a carload of concentrate now at the mill will be shipped. The property was recently acquired by the Idaho-Knickerbocker Mines Co.——A fire which broke out at the end of last week destroyed the plant of the Shoshone Concentrating Co. The damage is said to have been about $25,000, of which $15,000 was covered by insurance. The mill was built to treat the tailing of the Last Chance mine at Wardner, and preparations were being made for resumption of work at the time the fire took place. The cause of the fire is unknown.

Wallace, May 8.

MICHIGAN.

The Copper Range Railroad Co. has let a contract to construct a branch line to Point Mills, where will be erected a new dynamite factory by the E. I. Du Pont de Nemours Powder Co. Point Mills is east of Dollar bay, and north of the Franklin and Centennial stamp-mills. E. K. O'Brien, the construction engineer for the company, is on the ground and will have work started as soon as the branch line is completed.——Isle Royale's new hoisting and compressor plant at the No. 6 shaft is now in regular commission. The smaller 2½-ton skip has been replaced by a 7½-ton skip, and a second will be installed as soon as the skipway in the second compartment of the shaft can be made ready for the heavier duty. The shaft has now been sunk 75 ft. below the seventh level. The average copper content of the 'rock' milled shows a gradual gain since the first of the year, the higher average being due to the shipments from the Isle Royale lode in the No. 4, 5, and 6 shafts. The mill is treating between 900 and 1000 tons of rock daily, or about 27,000 tons monthly.

MONTANA.

BEAVERHEAD COUNTY.

A tunnel 1500 ft. long will be driven by the Calumet-Hecla Mining Co. at its Dark Horse claims southwest of

Dillon. Superintendent Lanyon estimates that a saving of $20 per ton may be effected by giving this outlet from the mine to a railroad siding at Baker.——Machinery has arrived in Dillon for the North Dakota Mining Co.'s cyanide plant, to be erected at the company's mine near Polaris. The plant will have a daily capacity of 25 tons. The machinery will be freighted up to the mine and installed just as soon as the roads will permit.

NEVADA.

CHURCHILL COUNTY.

George Wingfield and Eastern associates have taken an option on 600,000 shares of the stock of the Nevada Hills Mining Co. at $1.25 per share. The deal involves $750,000. The mine will be consolidated with the Fairview Eagle, its neighbor, and a large mill erected. The stock under option was held by W. W. Rice, of Salt Lake, James R. Davis, W. H. Clark, of Salt Lake, James Farrell, John A. Kirby, J. T. Hodson, and W. H. Webber.

CLARK COUNTY.

The 10 stamp mill of the Pompeii Mining & Milling Co., near Searchlight, has been started, under the management of Matt Hoveck. It was manufactured by the Risdon Iron Works. Hoveck has lately found high-grade ore in a raise east of the shaft, but considers that $8 ore will yield a substantial profit in the mill.

ESMERALDA COUNTY.

(Special Correspondence).—The Marigold lease on Rawhide Coalition has uncovered a 10-in. streak of rich ore in the south drift from the 160-ft. level. Assays are said to run about $500 per ton, with portions running as high as $1500 per ton. In the north drift the vein, about 1 ft. wide, averages $400 per ton. Work is being rapidly pushed at both points and the new shoot has been uncovered for several feet.——The Grutt Mining Co. is sinking on a 2-ft. vein reported to run about $300 per ton. Values continue with depth and the lease expects to make an early shipment.——In the bottom of the new shaft of the Miners' lease a 4-ft. body of fair-grade ore is showing.——Despite the fact that a large number of lessees are operating and that several are shipping high-grade ore, Rawhide continues very quiet, in marked contrast to the rush prevailing a year ago. Indications are promising for making several good mines, but the future of the camp depends on deep developments in the Coalition and Queen properties.——The Polaris claim has been purchased by a syndicate of Goldfield men and has been re-named the Big Six. Six hundred feet of the claim lies in the gulch which is attracting wide attention from placer miners. A 15-hp. hoist has been ordered, also a small pumping plant. Active work has commenced.——The Plamenaz lease on Union No. 9 has opened a vein running from a few inches to 2 ft. in width from the surface to the 291-ft. level. Drifts are being run on the 150 and 235-ft. levels with the ore extracted milling about $40 per ton.

Rawhide, May 7.

John Miller, one of the chief owners of the Lucky Boy and Alamo group of claims in the Hawthorne district, confirms the report that a 30 days' option on those properties has been given to the United States Smelting & Refining Co. in the sum of $1,500,000, and says that the first payment must be made by May 25 and the balance in five months thereafter. He says he is confident that the sale will go through, but will not be disappointed should the deal fail, as he considers that much more money than the stipulated price can be taken out of the ground within a year.——It is reported from Blair that the Lookout mine and mill, six miles from Oasis, which fell into the hands of the Risdon Iron Works of San Francisco to secure an indebtedness is soon likely to change ownership.——Forty additional 50-ton capacity steel cars for handling ore were delivered to the Tonopah & Goldfield railroad last week to keep up with the demand for cars by the Southern Nevada districts.

NYE COUNTY.

(Special Correspondence).—At a depth of 52 ft. the shaft at the Nemo Extension near Manhattan is said to be in a thin bed of gravel averaging $30 to $50 per yard. It is expected to strike the bedrock at a depth of 55 ft.——The recent clean-up of the placers of the McDonald lease is said to have run nearly $30 per cubic yard. This claim is centrally located and is surrounded by other leases, all of which are steadily working.——A section of the Wolf Tone Extension has been sold to J. R. Davis, A. A. Bissell, T. D. Murphy, and other Goldfielders for a consideration reported to be $25,000. Several nuggets have been found, together with some coarse gold, and the property will be actively worked for its placer wealth.——It should be remembered by outside investors who are not familiar with conditions that placer mining at Manhattan presents some drawbacks. It is not hydraulic or placer mining as commonly understood, but involves a complex system of handling several times, in addition to extended digging and washing. Costs are thus higher than in other districts, and many miners who have been in the Klondike and other placer fields do not think that the Manhattan placers are as valuable as recent reports would indicate. Many of them, after careful examination, have refused to invest, and predict that the placers will fall short of anticipations. While Tonopah and Goldfield mining men have every confidence in the placers, it should be remembered that Nevada miners have had little experience with this kind of mining, and are apt to over-rate indications.

Manhattan, May 7.

At a meeting of the officials of the Tonopah Extension Mining Co., held in New York, it was determined to build a mill immediately, and John G. Kirchen, general manager, was empowered to give the necessary orders. The new mill will contain 30 stamps, together with a cyaniding plant, having a capacity of 120 tons a day. The building will be put up large enough to accommodate 40 stamps, so that 10 additional may be hung at any time. The method of treatment will follow closely along the lines of the Montana, but the entire plant will be housed under one roof. The location of the new mill will be about 100 ft. west of the ore dump, on the south side of the Tonopah & Goldfield railroad tracks. ——The dividend of the MacNamara Mining Co. of Tonopah for the present month has been passed owing to the necessity of using the money to continue sinking the shaft, which is down past the 775-ft. level. The shipments for the past week aggregated six cars of ore, which were sent to the Western Ore Purchasing Co. at Millers. The mine shows no important change in condition.——Development of the new vein on the 150-ft. level of the Sphinx mine at Round Mountain is being continued by M. J. Kiely, who has a total of 22 men employed on the property. Milling is being done by one Huntington.——There is great activity at the Jefferson mine, near Round Mountain, where James McDonald is constructing a mill comprising crushers and Graupner rolls, Pinder concentrators, and 18 redwood cyanide vats. The principal motive power will be obtained from a Weber gas engine.

WHITE PINE COUNTY.

The output of the Nevada Consolidated Copper Co. in April amounted to 2,609,975 lb. of copper, the largest on record. The Cumberland-Ely produced in the same month 1,724,784 lb., making a total for the two companies of 4,334,759, or at the rate of more than 50,000,000 per annum. The new reverberatory furnace will be completed in 60 days and the fourth unit of the Steptoe smelter will be finished in 90 days. When these improvements are completed the plant will have a capacity of 75,000,000 lb. of copper per year.

SOUTH DAKOTA.

LAWRENCE COUNTY.

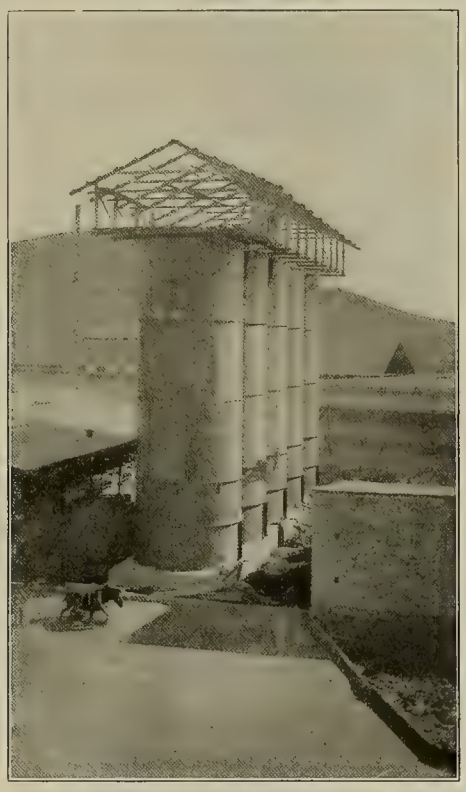
Arthur C. Luck, superintendent for the Robert W. Hunt Co. of Chicago, who is in charge of the building operations at the Hercules property at Galena, reports that construction of the 220-ton cyanide mill has been started. The Hercules Mining Co. owns 800 acres of mineral-bearing land. After crushing at the mine the ore will be conveyed to the mill by a cable tramway 1250 ft. long. Forty stamps will crush the ore in cyanide solution to pass through a 20-mesh

screen, when two Dorr classifiers will separate the slime and sand. A pair of 5 by 22 ft. Allis-Chalmers tube-mills will further reduce the sand, passing it to hydraulic cone classifiers. The coarse product is then to be returned to the Dorrs, while the fine joins the slime. The entire volume of ore will at this stage be reduced to the consistence of slime, and be passed to two Pachuca, or Brown, tanks, 15 ft. diam. and 45 ft. high, where agitation is effected by compressed air. A Butters filter will subsequently separate the solution from the leached slime.

WASHINGTON.

KING COUNTY.

The Seattle Cascade Mining Co. is developing a property close to Berlin, on which 500 ft. of work has been done, opening a vein of galena and silver ore from 18 in. to 4 ft. wide. Frank Jagerson, R. T. Dixon, and Frank Winquist are among the interested parties, and state that they will install a crusher, Chilean mill, and concentrating tables for



Brown, or Pachuca, Agitating Tanks.

treating the ore. The property is four miles from the railroad.——The Horseshoe Mining Co., of Seattle, has done 1250 ft. of development work on its two groups of claims, situated in Mt. Defiance range, between the middle and south forks of the Snoqualmie river, and six miles from a branch of the Northern Pacific railroad. Several veins have been opened, carrying copper, gold, and silver. The company has spent $1000 on buildings, $1400 for machinery and tools, and $1000 on road and trail. Swan Hansen is in charge of the work.

SKAGIT COUNTY.

The Skagit Queen, situated 40 miles from Marblemount, on Thunder creek, is resuming work on a cross-cut to intersect three parallel lodes embraced in the property. This cross-cut was driven 270 ft. last year and they expect to cut the first lode by driving 400 ft. farther. The company has installed a small air-compressor, operated by electric power, the generator being driven by a Pelton water-wheel. With this equipment air-drills were operated last year. Since then a larger installation has been made, said to consist of a 48-in. Pelton wheel, operating under 550-ft. head of water, carried by a 16-in. steel pipe 1500 ft. long.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—The continued strike of the coal miners in southern Alberta has resulted in the closing down of the property of the British Columbia Copper Co., throwing several hundred men out of work. The mine was closed down a few days ago, with the exception of a small force on special development work; the smelter closing as soon as things could be got in proper form. There is practically no change in the situation of the striking coal miners, and it is difficult to say just when a settlement will be made. It is estimated this will cost the copper company between $9000 and $10,000 per month for maintenance of openings, pumping, general supervision, etc.——The Snowshoe mine continues to send out about 2200 tons of ore to the Trail smelter. The total shipments from the Boundary district for the week ending May 1 amounted to 31,812 tons, the Granby shipments being heavier than they have been for some weeks.——By a decree of the Supreme Court the property of the Dominion Copper Co. at Boundary Falls and Phoenix will be sold on May 28 at Vancouver. The reorganization committee claims to have had $518,000 out of $800,000 outstanding bonds, deposited with them.——The first payment has been made on the bond which A. S. Locke and associates, of Winnipeg, have on the Donald Copper property, near Midway. J. C. Haas of Spokane has charge of the work and expects to develop a good body of gold-copper ore.——The shaft on the Golden Zone property is being driven at the rate of about 12 ft. per week. It has now reached a depth of 95 ft., and some of the best ore found on the property has been taken from the bottom of the shaft.

Phoenix, May 6.

MEXICO.

HIDALGO.

There is a severe drought of drinking water at Pachuca, but so far it has caused no reduction in activity in the mines or milling plants, as the companies use nearly all their water repeatedly.——The Loreto mill of the Cia. Real del Monte y Pachuca is milling 400 tons per day of raw ore that assays 1100 gm. in silver and 6 gm. in gold per ton. The Guerrero mill, belonging to the same company, but situated beyond the camp of Real del Monte, is putting through approximately 270 tons daily of ore that assays 600 gm. silver and 3 gm. gold per ton. The Guadalupe mill, using the old patio process, is treating good tonnages of ore, coming mostly from the Santa Gertrudis camp. La Union and La Paz mills are working slightly under full capacity, while the same is true of the two San Francisco mills which are treating custom ores only.

The Pachuca river works, operated by the Blaisdell Cocostitlan Syndicate, is putting through a good tonnage of the old tailings which resulted from milling operations of the past. Considerable construction work is being done by this company in order to increase the tonnage treated. Within three months the capacity of the present plant will have been tripled.——An abundance of milling ore with cheap electric power, which is supplied to the mines and mill at approximately ₱96 peh horse-power-year, are the main factors to which Pachuca's present condition of prosperity are due.

JALISCO.

At the El Favor mine, in the Hostotipaquillo district, all machinery and materials are on the ground, and satisfactory progress is being made in the erection of the 100-ton mill. It will be ready by the time electric power can be delivered, early in October. Makeever Bros. consider it advisable to increase the milling capacity, as they have sufficient ore available to treat 500 tons per day for many years.

OCEANIA.

FIJI ISLANDS.

Discoveries of mineral veins are reported from Suva, in these islands, and some Australian miners are on the ground examining them. Copper, gold, and silver are said to occur, but satisfactory arrangements have yet to be made with the local government to permit mining development.

Special Correspondence.

LONDON.

Mining Schools.—South Crofty Tin Mine.—Mountain Copper.

The three mining schools in Cornwall are to be amalgamated under the name School of Metalliferous Mining. Of the three schools, that of Camborne is of course by far the best known. It was founded in 1883, though classes were started six years earlier. In fact, courses of lectures were started in 1859, under the auspices of the Miners' Association of Cornwall. The first mining school in Cornwall was founded at Truro, by Sir Charles Lemon, even earlier, but did not last long. The establishment of the classes of the Miners' Association was due largely to the efforts of Robert Hunt, and it is interesting to record that Richard Pearce was one of the earliest lecturers. The present Camborne Mining School specializes on metalliferous mining and ore-dressing, rather than metallurgy, and in J. J. Beringer and J. G. Lawn it has two professors whose names are known the world over. The other schools are the Redruth School of Mines and the Penzance Mining School, both of which have done excellent work on a smaller scale. For some years there has been a feeling that these schools should be under one head, but there have been practical difficulties in the way. The recent Education Act provided a means of co-ordinating the educational system of the country generally, and steps can now be taken. The Board of Education has evolved a plan which has received general approval. The governing body of the School of Metalliferous Mining will consist of 22 members, of whom 14 will be nominated by the Cornwall County Council, and of the remainder 2 will be nominated by the Imperial College of Science & Technology, and 1 each by the Institution of Mining & Metallurgy, the Institution of Mining Engineers, the Iron & Steel Institute, and the Institutions of Civil, Mechanical, and Electrical Engineers. The Cornwall County Council is the local educational authority, and the Governors nominated by it will include several of the present committee of the Camborne school—Messrs. Holman, Pearce, Pendarves, Vivian, Thomas, and others. With this consolidation of mining education in Cornwall, it is probable that some arrangement will be made for co-operation between the School of Metalliferous Mining and the Imperial College of Science & Technology, otherwise the Royal School of Mines.

The directors of the South Crofty mine, in Cornwall, announce that "the ore left standing in the upper levels by the former workings, though of a very fair average grade, does not come up to the value the Board was led to believe." This is only too common in connection with Cornish mining. In the old days no records were kept. When re-opening the mines began everything depended on hearsay. A Cornishman is an optimist, so that the accounts of unworked mineral wealth are apt to become unconsciously exaggerated. To some extent the newcomers are to blame for not making thorough examinations for themselves, though, to do them justice, they are often dissuaded from doing so by the argument that it was an unnecessary expense. I have heard of more than one case where the demand of the outside engineer for a thorough sampling of the mine has led to considerable local friction. The South Crofty is a tin mine in the heart of the Camborne district, and adjoins Dolcoath. Its ores contain wolfram and arsenic and are therefore not so pure as those of Dolcoath. Three years ago the Allen-Meyerstein group in London took control and invited a large amount of capital. A new main shaft, now 1200 ft. deep, was sunk. Modern machinery was erected, with a dressing plant now consisting of 60 heads of California stamps, with vanners, Buss tables, and magnetic separators. The ore is very hard, and the stamps, crushing to 30-mesh, treat only 4750 tons per month, or slightly over 2½ tons per day per head. During 1908 only 40 stamps were running most of the year, the last 20 being erected within the year. The amount treated was 41,628 tons, and the yield was 442 tons of tin concentrate, sold for £34,162; 96 tons of wolfram, worth £8676; and 395 tons of arsenic, worth £3287. The recovery was 23.8 lb. of tin concentrate and 5.18 lb. of wolfram per ton. The cash value recovered per ton of ore was £1 2s. 1d., and the working cost £1 0s. 10d., leaving a margin of 1s. 3d. per ton. The cost does not include shaft-sinking and equipment, which are charged to capital, or administration expenses and depreciation, so that under present circumstances the mine is not yielding a profit. It is to some extent a matter of congratulation that no loss is being made, as is unfortunately true at some adjacent mines. It has been decided that, owing to the comparatively low content of the ore left in the upper levels, it is best to try the lower levels, which are at present under water. Accordingly the new shaft is being sunk another 150 ft., and pumps are being installed to reduce the water to that extent. The success at Dolcoath in developing ore at 3000 ft. should stimulate the directors of South Crofty to go even lower than present plans contemplate.

In writing about the Mountain Copper Co. a year ago I mentioned that the directors intended to go slowly with regard to the output of copper until they could market the remaining reserves at a higher price. Accordingly, during 1908 the output of copper from the better class ore has been restricted as much as possible, and the chief source of production has been the poorer ores which carry just sufficient copper to act as a carrier for the precious metals contained in the purchased fluxing ores. These ores are high in sulphur, and are used also for the production of acid. Unfortunately, the demand for acid has been very small recently, owing to the general depression in business. The output of copper during 1908 was 1838 tons, as compared with 3407 tons in 1907, and 2854 tons in 1906. The trading profits were £41,730, as compared with £157,127 in 1907. After paying for administration expenses and exploratory work, and settling the smelter smoke suit, an available balance of profit remains of £28,112. Exploration work has been chiefly confined to diamond-drilling. Here and there ore fairly high in copper has been found.

ROSSLAND, BRITISH COLUMBIA.

Output.—Consolidated M. & M. Co.—Canadian Metal Company.

The output of ore from Rossland is now nearly 5000 tons per week, despite the fact that the Le Roi is shut down. The Centre Star group alone is shipping 4300 tons. The rich ore-shoot in the War Eagle mine is developing splendidly. It is about 400 ft. long and 50 ft. wide, and has been cut on both the ninth and tenth levels of the mine. Several thousand tons of ore have been taken from this vein, and it is estimated that a million dollars worth of ore can be mined. The average tonnage for April from the lode carried $30 per ton in gold. Good results are being obtained in all of the Consolidated company's claims, including the Idaho and Iron Mask. The net earnings of the Rossland property of the Consolidated company will run from $30,000 to $40,000 per month. In the long-neglected South Belt recent finds seem to bear out the statement of Clarence King that the best and richest mines in Rossland would be in the South Belt. The rich showing made by the Blue Bird, the ruby silver lately found on the Hattie Brown, and other finds have turned interest in this direction. New York capitalists will do a lot of work there this summer. The three mines now working on rich galena are the Blue Bird, Hattie Brown, and Richmond. At a point 30 ft. from the surface average samples taken from a 2-ft. lead in the Blue Bird gave the following returns: gold 9 oz., silver 139 oz., lead 12 per cent.

The Centre Star-War Eagle group of mines, controlled by the Consolidated Mining & Smelting Co. of Canada, is in a position to mine and ship for treatment to its smelter at Trail about 10,000 tons of ore per week, should prices warrant, which is more than double the present output. The Granby Con. Mining, Smelting & Power Co. in the Boundary, by the middle of July expects to have the entire battery of eight furnaces at the Grand Forks smelter renovated and enlarged. This will give a smelting capacity of 4500 tons

per day, which the mines at Phoenix can supply without trouble. While the Le Roi mine is closed down, the managing director, A. J. McMillan, is in London, and the mine superintendent, A. G. Larson, is visiting the large mining and smelting plants of Colorado, Utah, and Montana. There is little doubt that the Le Roi will be working on its plan of deep and extensive development in the next few months, and if the price of copper and silver should rise, ore now ready for stoping in the mine could be shipped profitably. The British Columbia Copper Co. could also augment its output, and no doubt will in the next few months, as by that time the spur track will have been completed to its newly acquired mines in Wellington camp, where a big tonnage is awaiting shipment. The Dominion Copper Co.'s property is shut down, and the affairs of the concern are in a regrettable mix-up, but an order to resume work at the mines would come in a short time if it was known that a profit could be realized. The Le Roi No. 2, Ltd., at Rossland, is shipping about 700 tons of ore, or a little under that, per week, this ore being of a higher average grade than the usual Rossland ore, and assaying about $23 per ton. While the output of the Le Roi No. 2, Ltd., could be increased, they are not in as good a position as some of the larger companies, and besides this, the company is now re-timbering the main Josie shaft, with a view to centering its energies on the deepening of that shaft from the 900-ft. to the 1200-ft. levels and opening up the ground between these levels. The smelter receipts at the Le Roi No. 2, Ltd., for March were $62,361. Of this amount $59,151 was in payment for 3263 tons of ore and $3210 was in settlement of 112 tons of concentrate; a price of $18.11 per ton for the ore and $29.55 per ton for the concentrate, after deducting freight and treatment charges. This concern expects to pay regular quarterly dividends of two shillings per share this year, having just paid one such dividend. The company uses air power wherever possible about the mine. It is obtained from the Consolidated company. Electricity is used for hoisting, being taken from the high-voltage lines of the West Kootenay Power & Light Co. Its ore is smelted at Trail at a little over $5 per ton, including freight.

At Nelson, the Silver King is once again on the shipping list, sending over 500 tons of ore per week to the Trail smelter, and with prospects of larger shipments later on. Arrangements are in progress for the resumption of work at the La Plata and at the mines and smelter of the Sullivan Group Mining Co., but the future of these two properties will hinge on the price of silver and lead and some further light on the zinc question, both from an economical and treatment standpoint, this applying in particular to the latter property. In addition to the difficulties confronting the Sullivan company in regard to the mine, its financial affairs are being adjusted, but it is thought that the near future will see this part of the business in working form.

The Canadian Metal Co., of Nelson, is going into liquidation. It controls some lead-zinc mines, and a couple of years ago built a zinc smelter. Owing to certain concessions and the proximity of a plentiful supply of fuel, this zinc smelter was built at Frank, Alberta. It was a failure, being too remote from the source of ore supply. The company later bought the old smelter at Pilot Bay, on Kootenay lake, and remodeled it, but no great success has followed this enterprise. A new company will be registered as the New Canadian Metal Co., Ltd., with a nominal capital of $1,100,000, divided into 100,000 shares of a par value of $10 each, and 100,000 shares of $1 each. The shares will be issued as 75% fully paid, the amount of 25% of the par value remaining due from subscribers to the new shares. There is a good field here for a zinc-smelting works, and it is to be hoped that the New Canadian Metal Co. will make more progress than the old one did; if so, the results will be mutually beneficial to the company and to the much perplexed zinc miners, who are feeling glum again, now that it is known that the Payne bill imposes a duty of one cent per pound on zinc in ore entering the United States. Up to this time a quantity of the British Columbia zinc ore had found a market in the United States.

DENVER, COLORADO.

San Juan Conditions.—Clear Creek District. — Asbestos Industry in Wyoming.—Opening the Bijou Coalfield.—Cripple Creek.

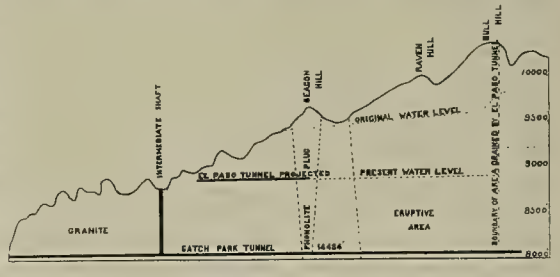
The unusually late spring has delayed the opening of many properties in the San Juan district. The Silverton Northern railroad has finally been dug out of the snow, and is handling an enormous traffic made up of the winter stock of ore in out-going shipments and of supplies and new machinery being sent in to the mines on Red mountain. The Ross Mining Co. has closed the bidding on the contract to extend the Pittsburg tunnel under the Champion mine on Sultan mountain. The Mountain Flower Co. has started extensive development work on its claims in the upper San Miguel district. A telephone line is being built to the mine and concentrating machinery is being assembled for the new mill, which is nearly completed.

The operators in the Clear Creek district are much encouraged by the new smelter that is being built at Utah Junction, north of Denver. There is scant prospect for the success of the venture, however. On May 7, the fiftieth anniversary of the discovery of gold in the Rocky Mountains was celebrated at Idaho Springs. A boulder, suitably engraved, was set on a concrete pedestal, on the spot where the first nugget was discovered. A company has been organized at Empire to develop the Headlight group of claims on Lincoln mountain. Surface improvements have been made and shaft-sinking begun. The Santiago mine, of East Argentine, has ceased operating on the leasing system, and will henceforth be operated on company account. The Argentine Central railroad has been completed almost to the mine, and the company believes that it can maintain a steady output.

A new industry is just starting at Caspar, Wyoming. The American Asbestos company is developing the extensive deposits of asbestos situated near there. Mining machinery and a fiberizing plant are being installed. The company expects to be competing with the Canadian product in the early fall.

The benefit of the Geological Survey work on the Denver coalfield is already becoming evident in the extension of the field to the vicinity of Fort Morgan. The Bijou mine has been opened to supply the local demand, and a large plant will be installed during the summer.

The Cripple Creek Deep Drainage tunnel is now more



Cripple Creek Tunnels.

than half completed. The progress during April was 986 ft. at the three headings. This is a phenomenal record for driving in the Pikes Peak granite. The management of the enterprise is worried over the problem of raising the remaining $166,000 necessary to complete the work. The annual meeting of the Eagle Ore Co. was held on April 17, and the old officers re-elected. The company sampled 193,000 tons of ore, valued at over $5,000,000, in 1908. The El Paso Consolidated Gold Mining Co. has let 31 leases on its Beacon Hill estate. This mine will be the first benefited by the drainage tunnel, and vigorous preparations are being made to take advantage of that event. The Golden Cycle Mining & Milling Co., owning and operating the Golden Cycle mine at Cripple Creek, and the mill by the same name at Colorado City, has purchased the holdings of the Pike's Peak Fuel Co., of Colorado Springs. A power plant is to be erected at the mine, to supply power to the mill and to customers in the city.

CANANEA, MEXICO.

Output of Copper.—New Plant.—Tailing Dam.—Mine Development.

The copper output for the Greene Cananea Co. for the month of March was 3,950,000 lb. The charge sent to the blast-furnaces, exclusive of coke, was 54,600 tons. The reverberatory smelted 7400 tons, mainly flue-dust, with 800 tons of calcine. The milling plant treated about 57,000 tons of ore, producing 18,000 tons of concentrate, dry weight, showing a reduction of a little better than 3 tons to 1. The output of the mines was approximately 80,000 tons, of which 20,000 tons was first-class ore sent direct to the spreading beds, and 60,000 tons second-class to the concentrator. The new large compressor is being installed at the main power-house, and the pipe-line to the various mines is being laid. This line will be 10 in. to the Veta No. 5 shaft, from where it branches to the America and Duluth 8 in., and from the Veta to the Oversight and Capote 8 inches.

The new dam across the gulch immediately below the concentrator is completed. This dam is for the purpose of catching the tailing, which carries 1% or more of copper. Although as yet no way has been found to treat this tailing profitably, L. D. Ricketts believes that the time will come within the next few years when they can be handled advantageously. At the new dam there is being installed a three-plunger electric pump to send the clarified water back to the concentrator. Much of the concentrator-water is flumed down from Puertocitos canyon. This new pump is needed to help out the supply, particularly during the dry season. The only recent improvement of importance at the smelter is the use of the new matte-pits, where matte from the reverberatory furnace is dumped and later sent to the blast-furnaces. Handling the reverberatory matte in this manner has reduced the coke-consumption at the furnaces considerably.

At the mines, development work is being pushed. In a cross-cut of the Henrietta No. 3 tunnel a 15-ft. vein of 10% ore has been found. Two prospect tunnels are being driven in the Pavo Real workings, showing only bunches of ore so far. At the Kirk another shaft has been put in operation. Work is begun at an old shaft between the Kirk and the America mines. This is one of the old America workings. Probably the most puzzling problem in the development of the mines is to find ore on the 200-ft. level of the America. On the 100-ft. level are good stopes of both first and second-class ore, the car samples of the first-class running 7 to 10% copper, but in spite of rather extensive development, comparatively little ore of value has been discovered below this level. At the Elisa a new 250-ton bin, with a conveyor and picking-belt system, similar to that at the Duluth, has recently been completed. L. D. Ricketts and W. D. Thornton have been for a month on a hunting and business trip in Mexico. Mr. Thornton, who is president of the Cananea Consolidated Copper Co., is also a director of the International Smelting & Refining Co., and it is supposed that the business was in connection with the latter company.

NEW YORK.

Electric Companies Amalgamation.—Fink Smelter.—Greene Liquidation.—Lead Prices.—Curb Stocks.

The Westinghouse Electric and the General Electric and their subsidiary companies are to be brought under one management. It is probable that they will be connected with the Amalgamated Copper Co. Representatives of the Amalgamated Copper Co. and of the International Smelting Co. have been instructed to take options on desirable coal and iron lands in the southwestern and western States. Options have been taken already on extensive coal lands in New Mexico and southern Utah. Samuel Newhouse states that plans are being drawn for smelters in Utah and Nevada, where the Fink process will be employed on a large scale. The experiments at the Boston Con. smelter have shown that the process can treat, at a cost of about $1.50 per ton, the ore now being shipped to and smelted by the A. S. & R. Co. at a cost of $6 per ton. The receiver of the Greene-Gold-Silver Co. will sell the company's holdings by auction in New York on July 1 next, and will apply the proceeds to the payment of the company's debts. W. C. Greene, the promoter of the company, claims that it owes him $2,000,000, but this amuses the stockholders, and does not trouble the receiver. Greene is still in Mexico for "the good of his health," and is not likely to visit New York and press his claims. It is probable that the sum realized by the sale will be insufficient to liquidate the company's debts.

Notwithstanding the fact that zinc ore abounds in many districts in Mexico, up to the present time no substantial attempt has been made to smelt zinc in Mexico on a commercial scale. Recently J. O. Willett, of Saltillo, Mexico, received a Government concession for zinc smelting. A syndicate is being formed by American capitalists, and it is probable that a smelter will shortly be erected at Sabinas. The price of lead has advanced several points. Reports from London are that J. P. Morgan has succeeded in perfecting arrangements whereby large international dealers in lead in Europe will work in unison with American dealers, and that the price of lead will be advanced, with that of copper, to high figures. To allay the fears of metal workers, Edward Brush, vice-president of the A. S. & R. Co., has issued the following official notice: "The American Smelting & Refining Company knows of no world-wide lead trust that has been formed to advance prices being in existence, or in process of formation. The A. S. & R. Co. has not joined any such trust, and does not expect to do so. The lead market is strong at the present time because of the great Australian lead mines being closed down by strike. The quotations of lead are now abnormally low, and the price will advance somewhat, due to natural causes. The A. S. & R. Co. does not look to see any abnormal advance in the price of lead, and knows of no reason which is likely to bring about any abnormal increase in price."

Mining stocks on the New York curb market continue heavy. Strenuous attempts have been made to infuse life into cobalt-silver stocks, but brokers report unsatisfactory results. Dull times on the curb have caused a number of the brokers to fail.

WASHINGTON.

Lead Tariff.—Customs Court.—Homestead Laws.

The Senate has agreed to a duty of 1½c. per pound on the lead content of all lead-bearing ores, thus settling this feature of the tariff bill.

A bill to create a United States Court of Customs Appeals has been introduced in the House by James C. Needham, Representative from Modesto, Cal. The measure provides for a chief justice and two associate justices, at a salary of $10,000 each, and that the Court shall meet in Seattle, Portland, and San Francisco. Mr. Needham presented another bill which provides for a continuation of the investigation of the rivers and water resources of the United States by the United States Geological Survey. Simon Guggenheim, Senator from Colorado, has introduced a bill appropriating 25% of all money received for mineral land within the State of Colorado for the maintenance of the School of Mines established at Golden. Thomas P. Gore, of Lawton, Oklahoma, the blind senator, has introduced, by request, a bill granting additional rights to homestead settlers on public lands. It provides that any homesteader shall be allowed to leave from October 15 to April 15 of each year for the purpose of securing employment when such cannot be obtained on the homestead. The bill contains the provision that no leave of absence after the first shall be granted unless the homesteader makes affidavit to the effect that he saved at least $10 per month for improving his homestead while he was away, and that he has expended in the way of clearing the land and bringing it under cultivation since his last absence the sum of $20, times the number of months of his last absence, his own labor to count for reasonable wages. A bill authorizing reinstatement of commutation certificate for homestead entries when cancelled for lack of residence if entryman has resided continuously on entry the eight months preceding the making of proof, has been presented to the House by Moses P. Kinkaid, of O'Neill, Nebraska.

TORONTO, CANADA.

Gillies Limit.—Gowganda —La Rose.—Nipissing. — Silver Queen.— Temiskaming.—Cobalt Shipments.

The Ontario Government is offering for sale 1000 acres of the Gillies Limit adjoining the Cobalt mining district. The Provincial mine is situated in this area, but is not to be sold. The property will be disposed of in lots of 20 acres each, subject to 10% royalty on the value of the output and a proviso that successful tenderers must expend $400 annually in development for 7 years. Tenders will be received up to June 1. Mining men are disposed to consider the action of the Government as ill-advised at the present time when investors are surfeited with mining propositions of a much more tempting character. Notwithstanding the experimental work undertaken by the Government the Gillies Limit is still an unknown quantity as regards valuable mineral discoveries. The Provincial mine did indeed make one or two shipments last year, but has made none since, and from the care that has been taken to suppress all information as to the value of the ore obtained, or the extent and character of subsequent development the inferences drawn are naturally unfavorable.

The isolation of Gowganda is so complete that the Post Office Department has announced that no mails, with the exception of letters, can be forwarded to Gowganda, Elk Lake, and Wigwam until navigation opens, which at earliest will be about the middle of May. A Government engineer has been sent to survey a wagon-road which is to be built from Charlton at a cost of $50,000. Construction will not commence until June. During the last week or two, while the winter roads were still passable, freighters were charging $100 for the round trip of 42 miles from Charlton to Elk Lake. A steam-boiler which was shipped from Charlton to Elk Lake for the Silver Horn mine west of the latter point was three weeks in traveling 21 miles, and the cost of transport was $2000. It is evident that not many dividends need be expected so long as such conditions obtain.

The La Rose, at Cobalt, has secured the Lawson property by exchange of stock for outstanding shares of the Lawson Mines Ltd. to the extent, it is stated, of about $1,750,000. The property acquired embraces 40 acres cornering on the Crown Reserve and lying adjacent to the Kerr Lake. Development has been retarded by protracted litigation. The Silver Leaf shaft, which was sunk by the Silver Leaf Co. on the Lawson tract, owing to a mistake in the survey, has been pumped out and driving will begin at 160 ft. Another shallower shaft will be put down to the same level. The annual report of the Nipissing was of a highly optimistic character, showing the total value of ore produced in 1908 to be $1,410,068, and the net profit $903,090. The net surplus on hand at the close of the year was $803,326. President Earle stated that of the 846 acres owned by the company 383 are still unexplored and the remaining 463 only partly prospected and developed. The vein of rich ore at the 172-ft. level in shaft No. 64 is 16 in. wide and assays about 1700 oz. silver per ton. It is estimated that every block of ore on this vein 100 ft. long and 100 ft. deep, of this average grade, will net $1,750,000. The Argentum Mines Ltd. has entered into an agreement under which it will operate the Foster in connection with its own mine for five years. The annual meeting of the Silver Queen shareholders was held here on April 28, and the financial statement was by no means of a hopeful character, the principal available asset being the low-grade ore on the dump, the value of which is estimated at $25,000. The Northern Custom concentrator will begin treating this early in May. Prospecting by diamond-drill will be carried on in the hope of again striking good ore. Capt. W. H. Jeffrey has resigned his position as engineer of the Chambers-Ferland, and on May 1 C. Watson, assistant superintendent of the Nipissing, was to replace him. A new vein carrying cobalt and native silver, 2 to 3 in. wide, was recently uncovered in trenching. At the Temiskaming rich ore is being taken out of the vein on the Gans area at the 200-ft. level, which is 10 in. wide, with good milling ore on either side. A steel shaft-house, open on all sides, the first of the kind in Cobalt, is being erected. It is over 70 ft. high and rests on a solid cement foundation. The new 3-compartment shaft is down 350 ft. and when complete will be connected with the workings from the other shafts by cross-cuttings. The Kerr Lake has the deepest workings of any in the camp, being down 400 ft. The manager, S. R. Heakes, states that they have ore at that level averaging as high as any. The output, however, is being steadily restricted to 180,000 oz. silver per month, or about two tons of ore per day. The total cost of production is 7c. per ounce. The assets of the Green-Meehan, in accordance with a vote of the shareholders, have been made over to the Consolidated Silver Cobalt Mines Ltd. Trethewey has declared an interim dividend of 10%, payable May 15. The main shaft of the Hargrave is now down 215 ft. When it is 92 ft. deeper a level will be run in as far as the Kerr Lake boundary to catch the Kerr Lake vein at that depth, which is supposed to extend into the property. The Coleman Cobalt property, belonging to the Amalgamated, has been secured by the Michigan Development Co., organized by Detroit men with S. D. Madden as manager, and is being operated with air supplied by the Kerr Lake Majestic. The shaft is down 60 ft. The Michigan has also leased the Silver Bird, one of the swindler Frank Law's flotations. Frank C. Armstrong, of New York, this week brought a large party of Nova Scotia and New Brunswick capitalists to Cobalt to inspect the properties of the La Rose and other mines. Shipments continue heavy, the total for the two weeks ending April 24, being 1139 tons. But the number of contributing mines is comparatively small.

JOHANNESBURG, TRANSVAAL.

Randfontein Central Mill.—Stope-Drill Competition.

No mining group advertises itself less that that controlled by Sir J. B. Robinson in the West Rand. Formerly, when the Randfontein group was anything but progressive, this lack of information was unimportant. Today, however, big movements are on foot and reliable data are welcome. The announcement is made with seeming authority that the work of excavation for the erection of the authorized 600-stamp mill has already been commenced at the Randfontein Central. This is to be supplemented by 16 tube-mills, and is to be driven electrically, each ten stamps being run by an independent motor of 40 to 45 hp. as at the Simmer Deep. This will be the largest stamp-mill in the world, and indicates how far the policy of centralization is being carried in Rand practice. Following the popular ideas of today—first put into practice by the Bantjes company—the designers of the new Randfontein mill propose to house the amalgamating tables, together with the shaking tables usually below the tube-mills, in an entirely separate building. The mill itself will come under the engineer's department.

The underground elimination trials of the Stope-Drill Competition have now been commenced and the early results have proved the danger of placing too much reliance in the order of merit established by the surface tests. The Westphalia, which ran wonderfully well on surface, making 4.21 in. per minute on running time, has shown up badly underground. Its automatic feeding device gave trouble and the steel jammed in the hole frequently. The Murphy ran very steadily underground and averaged 1.8 in. per minute. The results of the surface trials have been tabulated by the committee and show that the Siskol heads the list with the remarkable speed of 4.34 in. per minute, with the Westphalia second at 4.21 in. The Siskol is a reciprocating machine, weighing 95½ lb., using hollow steel, while the Westphalia is of the hammer type. The third on the list is the Chersen, which made 4.11 in. per minute. This is of the reciprocating type. Special interest attaches to this machine owing to its local origin and to its comparatively extensive use in the mines, where it has given satisfaction. The two Denver drills, the Murphy and the Waugh, stand eighth and twelfth in the surface trials, with speeds of 2.92 and 2.43 in. per minute respectively.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Size of grain is an important factor in determining the fusing behavior of clays.

Silver purchases during the year 1908 amounted to 33,404,136 troy ounces. Of that quantity 3,012,532 oz. came from parting gold bars.

Anhydrous silica is practically inert at ordinary temperatures, but at temperatures attained in brick kilns it becomes active, expanding and forming many compounds.

Diamantine is a product of the electric furnace, practically a silicide of aluminum, formed by heating silica and alumina together. It is a refractory material of value for coating the interior of furnaces and flues.

Excess alkali in cyanide solutions is not the same as protective alkali. The latter is determinable by direct experiment only, whereas excess alkali is a matter of easy estimation by ordinary alkalimetric methods.

Graphite exists in two forms: crystalline (or flake) and amorphous. It is known to the trade by the names of black lead, plumbago, and graphite. Black lead usually refers to the inferior grades of graphite, plumbago to the Ceylon product, and graphite to the American product.

Lubrication is effected by interposing between the surfaces, films of liquid or soft solid substances, which decrease friction. If the liquid film is too viscous, or if the soft solid substance has too much body —not of the proper consistence—a condition exists which is similar, but in a lesser degree, to that when two solids rub together.

Milk of lime was used for chemical treatment of boiler water as much as 50 years ago by Clark. It is still the best treatment for waters the hardness of which is due almost exclusively to bicarbonates of calcium and magnesium. It has no effect on neutral calcium sulphate, which is a common cause of hardness in natural waters.

Surface tension is due to the fact that particles on the surface of a liquid are not affected by molecular attraction on the outer side. Since material tends to move from points of low to points of high-potential, the surface particles strive to reach the interior of the liquid, and thus produce a tension of the surface.

Holes in castings are generally filled by means of a paste consisting of powdered sulphur 1 part, sal-ammoniac 2, powdered iron turnings 83. This sets but does not repair the weakness caused by the defect. That may actually be done by the use of thermit, if the surface of the cavity is sufficiently accessible to admit of cleansing. A casting, however, containing visible blow-holes will almost certainly contain others, and is liable to be badly piped. Hence it should not be trusted where subjected to much strain.

Mining claims may have broken end-lines, according to decisions of the courts, but the extra-lateral right is not conferred except as it would proceed from straight parallel end-lines. It is doubtful whether the Land Office would issue a patent to a claim when the boundaries by original location were laid down with end-lines containing any angle or change of course in their length.

Magnesium salts are the most corrosive of any that are usually found in boiler waters. Besides their indirect corrosive action, in the case of magnesium sulphate, there is a possibility of forming hard scale through reaction with calcium carbonate. If any magnesium sulphate is present, at high pressures the following reaction may take place:

$$4CaCO_3 + 4MgSO_4 + H_2O = 4CaSO_4 + (MgCO_3)_3\,Mg(OH)_2 \times CO_2.$$

Mining claims on the Rand are about 15 acres in extent, and ownership is restricted within vertical bounding planes, no extra-lateral rights being conceded. The rule originally prevailing among engineers for determining the proper relation between vein-volume and milling equipment was one claim for each stamp-head in the mill, the stamp-duty being assumed at 5 tons per diem. The increase in duty of stamps, and the variations in gold-content in the veins, have led to providing five claims for each stamp-head in more recent estimates.

Toughness is the most essential quality in paving brick. It is conditioned by the character of the clay and the method of burning. It is necessary that the brick should be brought to the point of incipient fusion and held there long enough to produce a well-bonded homogeneous mass, but without complete fusion. In a good paving brick the unfused particles are cemented by thin films of newly formed silicates. Complete fusion results in the formation of a worthless glass. While it is technically possible to make pavers from a wide variety of clays, it is not economical to do so except with clays having a range of at least 400 degrees between incipient and complete fusion.

Jade is a term loosely applied to various minerals of a translucent white to dark green color. Typical jade is of a lustrous dark green shade, and is either jadeite, a mineral belonging to the pyroxene group, or nephrite, a variety of amphibole. Both are used extensively in China, nephrite being the more common. It is found in the Far East, in New Zealand, Mexico, and Alaska. The white variety of nephrite is tremolite, the dark green, actinolite. Its hardness is that of quartz and its specific gravity from 2.96 to 3.1. Jadeite is heavier, ranging from 3.33 to 3.35. It is the more valuable of the two kinds of mineral commonly known as jade. In composition it closely approaches spodumene, which yields several varieties of gem stones.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mine Accounts for the Superintendent.

The Editor:

Sir—Algernon Del Mar's article under the above heading invites suggestions with a view to arriving at a standard set of forms. I venture to submit those I have used for a number of years. My remarks are confined to mine forms, as mill forms will vary with the method of reduction.

The time check form is shown in Table I.

TABLE I.

Form No. 4.

Supt. .....

NORTH POLE MINING CO.

Time Check.

..... has worked as

....days at $..... $.....

.... days at ....

——— $.....

Deductions, Board..... .....

Hospital ....

....

Net..... $.....

Countersigned. .....Foreman.

This form is clear—an important matter where many of the men are foreigners. Countersigning is only necessary when checks are to be held until payday or negotiated. They are bound in books arranged for carbon duplication, and written with an indelible pencil.

As the number of positions of men at work are fully shown by the time-book, Form No. 1 is reduced to number of tons of ore (of each class) and of waste hoisted. I find it handier to have 'Requisitions' on a separate form, since some days there are none, while on others many are required.

The foreman's weekly report (Form No. 2) is the same as used by Mr. Del Mar, except that the arrangement of the columns has been: Progress, Tons ore (of each class), Tons waste, Timbers, Lagging, Powder, Fuse, Caps, Candles, Drill steel. Three or four wide columns are reserved for tools and supplies not regularly used.

The foreman's time-book is ruled as in Table II.

The letters correspond to those of Form No. 2. A refers to Shaft No. 1, B to Shaft No. 2, and E to Raise No. 1. To prevent confusion, I and O are not used. This is a convenient way to keep the time where men frequently work in different parts of the mine in the same month. The one form shows the labor done at each place and where each man worked each day. In case of change of occupation a separate line should be used, at least in the office time-book. This is a much larger book, with the left side ruled as in Form 3, up to the 'Rate' column. The ruling of the right side is illustrated in Table III.

For the superintendent's monthly reports the forms are the same, but under 'Working Place' the capital letters used in Form No. 2 are inserted. The columns are headed:

Ore Extraction. Working place, Average number men, Total shifts, Cost labor, Cost supplies, Total cost, Number tons ore, Cost per ton, Average value, Tons waste, Nature of ground, Remarks.

Development. Working place, Average number men, Total shifts, Cost labor, Cost supplies, Total cost, Total length, Progress, Cost per foot, Width ore, Average value, Tons ore, Tons waste, Nature of ground, Remarks.

These forms record progress and extraction of waste and ore, and recapitulate the time and supply books in a convenient way. If details of supply consumption are desired they can be given through a copy of the supply book. Instead of using a pay-sheet as per Form No. 8, I prefer individual receipts. These are in the same form as the time checks (Form No. 4), except that the words 'Time Check' and the superintendent's and foreman's signatures are omitted, and the words "Received the above amount as

TABLE II.

North Pole M. Co. Time Book. Month of..... Form 3.

NAME.	OCCUPATION.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Days	Rate	Board
J. Browne	Miner.	E	E	E	E	E	A	A	A	A	A	A	A	A/2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E	E	30½	4.00	$31.00
J. Smith	Machine.																				B	B	B	B	B	B	B	B	B	B	B	B	12	5.00	12.00
A. Adams	Mach. Helper.																						B	B	O	O	B	B	B	B	B	B	8	3.50	10.00

TABLE III. Form 3A.

Days.	Rate.	Total.	Deductions.			Total Deductions.	Net.	Distribution.					
			Board.	Hospital.				A	B	C	D	E	Etc.
30½	4.00	122 00	31.00	1.00		32.00	90.00	82.00				40.00	
12	5.00	60.00	12.00	.50		12.50	47.50		60.00				
8	3.50	28.00	10.00	.50		10.50	17.50		28.00				

TABLE IV.

	On hand first of month.		Bought.		Total.		Used.	Charge account of		On hand last of month.	
	Quantity.	$	Q	$	Q	$	Quantity.		$	Q	$
Powder	200 lb.	32.00	2000	320.00	2200	352.00	200 lb.	A	32.00		
Powder							400 lb.	B	64.00		
Powder							100 lb.	E	16.00	1500	240.00
Fuse, and so forth											

payment in full for work done in the month of....." are added below, with a space for the employee's signature. They are issued to the men a few days before pay-day for examination and, if necessary, correction before the pay-checks are drawn. On pay-day the men bring these receipts, already signed, to the office and exchange them for pay-checks. My experience is that the time saved in paying off more than compensates for the slightly greater clerical work (which can be done at any time), and that this system is specially convenient where duplicate receipts for all payments have to be sent to the head office.

The supply book is arranged as above: Table IV.)

The capital letters in the 'Charge account of' column correspond, of course, to those used in Forms 2 and 3A. The totals of amounts charged to accounts A, B, etc., are entered at bottom of last page for the month. To collect these the right-hand portion of Form 3A, or a like arrangement on rough paper, can be used.

The boarding-house supply book is in the same form, except that there is no 'Charge account of' column. In these supply books the values are figured with the freight added. The amount on hand at end of month is checked by actual inventory at least every quarter. I usually carry the cooks and waiters in the general time-book, and a line in the general supply book for the totals of the boarding-house supply book, the 'Boarding house account' being assigned its capital letter in Forms 3A and 10. The two last mentioned forms are bound in books, and loose sheets, similarly ruled, are used if copies are required by the head office.

In conclusion, as much as possible of the form-filling should be done in the office, and very little of this put on the foreman, whose place is in or at the mine. Such work is often uncongenial to him, and in practice even Form No. 2 is often filled in with some help from the office staff. All forms should have ample spaces and not be cramped in any part. This particularly applies to those used by the foreman.

Whether such accounts as M (Engine room) and P (Miscellaneous) shall be distributed at the mine or head office is a matter for arrangement with the directors. I have found the system of forms described above a convenient method of keeping accurate record of the cost of any particular work and all other matters which should be recorded except those which are covered by the accountant's books.

HAROLD WILSON.

Denver, Colorado, April 10.

How It Strikes an American.

The Editor:

Sir—Your contributor, Mr. Lane Carter, in his interesting articles on 'How It Strikes an American' on returning home from South Africa, refers to the question of ventilation. It is worth recalling that the Transvaal Government limits the number of underground workers; that is to say, each mine has to declare the number of workers and obtain the permission of the Government Inspector for a maximum number, which is determined by general conditions and ventilation. For instance, the Cinderella Deep in its report recently issued, mentions that until November last the maximum allowed was 400. As the company desired to increase the amount of development the directors had to approach the Government, which at once allowed an increase of 100, and, providing certain additional ventilation plant was installed, a total of 650 would be allowed. This factor must be taken into account in all plans for mine extension in South Africa.

EDWARD WALKER.

London, April 28.

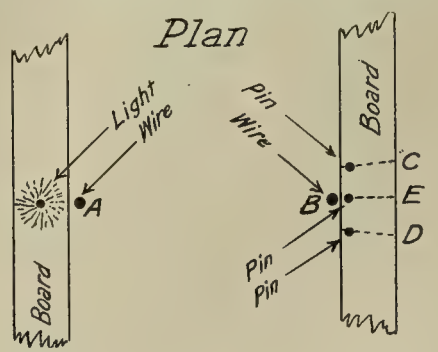
[While it is true that in America the number of men allowed to work in any one mine is not limited, the same result is indirectly accomplished in all coal mines by the common provision that a certain amount of free air per minute must be furnished for each man and mule in the mine. An ordinary requirement in a non-gaseous mine is 100 cu. ft. per man and 500 per mule. In mines yielding gas in quantity the requirement is higher. The great extent of underground workings in the Rand mines has introduced problems of ventilation similar in some respects to those of the non-gaseous coal mines. This is a stage in metal mining not reached in America, except in special instances, such as certain mines at Cripple Creek where gas is given off in quantity. So far the number of such instances has been so small as not to require special regulation.—EDITOR.]

Mine Surveying Hints.

The Editor:

Sir—I read with interest Edmund D. North's article on 'Mine Surveying Hints' in your issue of February 13; and can see considerable advantage in inclined hairs in the telescope; but few instruments have them. I have had considerable experience in underground surveying, and to transfer surface lines underground by means of two plumb-lines, which always seem to maintain a slight oscillation, makes it difficult to line up with them by the ordinary method of sighting first upon one then upon the other. The best method I have discovered is to find the centre of oscillation of each, and then line up with these two points. This can be done as follows:

Place back of each wire a board or timber as close to the wire as possible, without touching it. Then place a torch, or two or three candles together, back



of one of the wires as A in the sketch and get the light close to the wire, and as near in line with the other wire as possible. This light will cause a

shadow of the opposite wire as B to fall on the board back of it. Now follow this shadow as it moves on the top of the board, due to the oscillation of the B wire, until it reaches the end of its course and starts back, and place a pin in the board at this point, as at C. Now follow the shadow back until it reaches its limit in the opposite direction, and place another pin at the point, as at D. Place a pin mid-distant between these two pins, as at E, and the centre for the B wire is found.

Take the light from behind the A wire and place in the same manner behind the B wire, and proceed to follow the shadow of the A wire on the board back of it.

Bisect the distance between the pins as found, and place a pin at the point for the centre of the A wire. Line up with these two centre pins. Being stationary this is easily and quickly done. I submit this in the hope that it may prove a help in what is ordinarily a tedious operation.

H. H. Holbert.

Courtland, Arizona, March 7.

Vacuum-Pump in Cyaniding.

The Editor:

Sir—With reference to the article on 'The Vacuum-Pump in the Cyaniding of Sand', reproduced in your issue of February 27, Mr. Caldecott is in error in stating that "the use of the vacuum-pump in cyanidation is as old as the first introduction of the cyanide process in this district by J. S. MacArthur in 1890." The vacuum-pump and the cyanide process were both introduced into South Africa before J. S. MacArthur ever arrived in that territory. It is true that there has been a tendency in later years in South Africa to regard the use of the vacuum-pump as of no advantage, but the continuous use of this appliance elsewhere has amply justified our original recommendation of it in connection with cyanide treatment.

Alfred James.

London, April 5.

A Case of Salting.

The Editor:

Sir—Some years ago an engineer was called upon to investigate cyanide operations in a plant connected with a property of which I later had the management. The primary cause of the investigation was a very strange shortage of bullion recovered when checked against estimates based on assays. After a general survey of the plant, standardizing solutions, etc., a number of assays were run on original sand and slime, and on residue of the same after treatment. The cyanide solutions before and after contact, and after passing through the zinc-boxes, were also tested. The results showed such wide disparity that it was resolved to assay all the fluxes. These were found to carry gold and silver, and a fresh lot was ordered. The latter, arriving sealed, were accepted as free from precious metals, but on running the usual blanks a variable gold-silver button was still found. Finally the unused cupels were ground and assayed. All the bone-ash was found to carry gold and silver. We concluded that this salting was accidental, and arose through carelessness in drying precipitate. The dust therefrom settled in receptacles that contained flux, or other material, and being in the bone-ash when the lead buttons began to melt, caused a continuous picking up of the metal in the bath from the surface of the cupels.

H. Vincent Wallace.

Nogales, April 15.

Fighting Fire With Snowballs.

The Editor:

Sir—While on a visit recently in the Sierras, at the Morning Star mine in Plumas county, California, we were startled at breakfast by the cry of 'fire'. We ran to the rescue, and found flames leaping up the hoist-tower. Something had to be done quickly or the fire would be beyond control. No ladder or other means could be found for reaching the fire; not even a bucket. This was reprehensible, to say the least; but how many other properties have neglected fire-precautions? Someone thought of snowballs, and immediately the big wet snowballs were flying from a dozen hands, at and above the flames, which by that time were mounting high up the structure. The snow stuck to the boards, melted, ran down, and smothered the fire in a very short time. Thousands of dollars worth of property and much valuable time were saved, and the men continue to hold their jobs, all because a trick we had learned as boys was put to a useful end.

W. L. Cobb.

San Francisco, April 21.

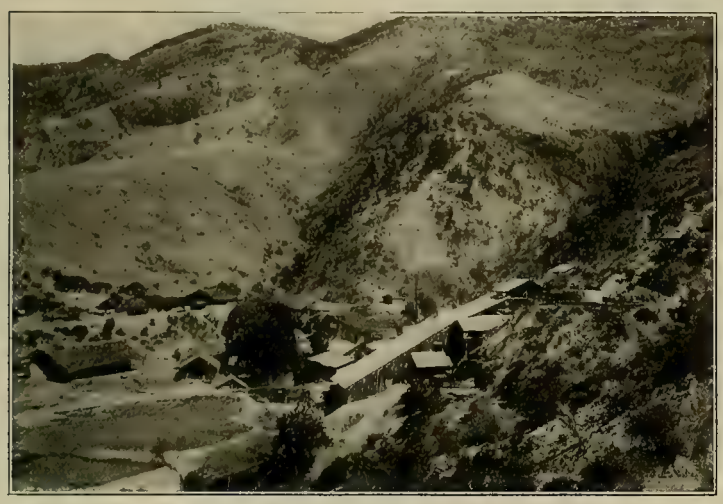
Surface retardation in open channels, or, in other words, the phenomenon that the filament of maximum velocity in a stream is some distance below the surface, is explained by a simple hypothesis advanced by A. H. Gibson in a paper read before the Royal Society, January 14, 1909, on the 'Depression of the Filament of Maximum Velocity in a Stream Flowing Through an Open Channel'. The frictional retardation due to sides and bottom tends to set up eddying movements in the water, the plane of the eddies being inclined inward toward the surface of the water. The tendency toward this eddying flow, combined with the free flow along the stream, produces a surface-current setting from the sides toward the centre of the stream, and correspondingly an outward bottom-current. These currents carry the slower-moving water which was in contact with bottom and sides and was retarded by their friction, toward the surface at midstream, and retard the velocity of the downstream flow at that point. Near the middle the currents set downward, receiving accelerated downstream velocity, and finally flow outward again near the bottom. Their retarding effect makes the velocity near the surface less than the ideal velocity of flow, whereas at some depth below the surface they have a lesser retarding effect. Mr. Gibson has demonstrated the existence of the cross-currents by observations in a test-flume, in a river channel and in a narrow earth canal.

CALABACILLAS GOLD MINE.

Written for the Mining and Scientific Press
By Charles Walter Geddes.

The Calabacillas mine, in the State of Chihuahua, Mexico, close to the junction of the States of Chihuahua, Sinaloa, and Durango, is perhaps one of the most interesting mines of the entire West Coast, not alone for the reason of its being one af the few new gold mines of Mexico, but also because of its development, since its discovery by a native Indian, by local Mexican owners. It now represents one of the few 'one man' gold mines of the world. The purity of the gold contained in the ores, and the almost perfect saving by direct amalgamation, allows the use of the oft abused term 'free-milling ore.'

The original discovery was made accidentally by an Indian, bearing the same name as the famous Apache chief, Geronimo, in the year 1899. He sold his entire interest for an old musket and two cows.



Calabacillas Mill.

The property then passed into the hands of a Mexican syndicate and was worked for several years on a unique co-operative plan. Starting on the surface where rich ore was discovered, shallow shafts, pits, and trenches were made and the ore so extracted divided among the different owners in proportion to their holdings in the syndicate. After this division, by weight or measurement in boxes, with no regard to the values contained, the respective owners would convey the ore to their homes, or haciendas, and treat it in arrastres.

Later two Bryan mills were installed, and the operations better organized. During this period the property produced $530,000 gold at small expense. The usual vicissitudes attending the transition of a prospect into a mine occurred during the next two years until the entire property and plant was purchased outright and individually by W. H. Brevoort, of New York and Paris. The mine is now in active operation, and has made a total production to date of $900,000. The mine is in the same range of mountains, paralleling the west coast of Mexico, in which are the famous old mines of Guadalupe y Calvo, Morelos, Batopilas, Son José de Gracia, and the more recent Lluvia de Oro, the latter being one of the sensational discoveries of the latter decade. The range is composed mainly of andesite, broken here and there by intrusions and extrusions of later porphyries. At Calabacillas is an intrusion of rhyolite, in andesite, having an average width of about 500 ft. on the surface and traceable several miles, until it is lost under more recent flows, tuffs, and breccias. The intrusion forms a sharp anticline on its contact with the andesite, one leg of the anticline having a dip to the east and the other to the west. Development has so far been confined to the east contact, exposing a zone of brecciated and fissured material extending into the rhyolite a distance of 150 ft. The mass consists of ore-shoots characterized by a regular system of fissuring both parallel and transverse to the main contact. There have been developed four, and possibly five, separate, distinct ore-shoots, varying from 65 ft. by 15, to 100 by 70, and the conditions warrant the expectation of other ore-shoots along the strike.

The brecciated rhyolite has become silicified by percolating solutions, and the gold has been deposited in the fissures and seams of the brecciated mass, in connection with different iron minerals. The term 'free-milling ore' has been so misused that it has lost practical significance, but at Calabacillas is an absolutely typical free-milling ore. Fine-grinding tests indicate that with sufficient plate-area from 95 to 97% of the total gold-content can be saved by amalgamation. The silver content is practically nil, the retorted bullion showing only 35 oz. silver to 500 of gold. Due to the character of the ore the milling practice is simple. The original mill consisted of two Bryan mills with plate-area of 4 by 12 ft. Later 10 stamps of 850-lb. weight were added. Inside amalgamation was used, with an outside plate-area of 4 by 10 ft. to each battery. A small cyanide plant was installed, having a daily capacity of 15 tons. Recently another battery of 10 stamps, of 800-lb. weight each, was installed, and the Bryan mills discarded. There is now being installed a very simple cyanide leaching plant, equal to the present capacity of the 20 stamps, which is 40 to 50 tons per day.

The ore as broken in the mine is delivered to the mill by a surface tramway, passed over grizzlies, and the coarse through a 10 by 11-in. Dodge crusher, crushing to one inch; then to the batteries. The stamps have an 8-in. drop, 100 drops to the minute, and crush the ore through No. 30-mesh screens, using inside as well as outside amalgamation. The pulp is carried direct from the plates, by launder, to the tailing dump, where 15 tons daily are used in the present cyanide plant, the remainder being impounded for future treatment.

The average daily run shows a saving of 80% by

straight amalgamation, when crushing through 30-mesh, while the cyanide plant, after 5 days leaching, recovers 80% of the value contained in the tailing, making the total saving 96%. Below are monthly records taken at random from the mill books, showing recovery by amalgamation alone, and *not* including results of the cyanide plant:

Tons milled	820
Assays: Heads	$15.00
Tailing	2.89
Extraction	12.11
Extraction, %	80.70
Amalgam recovered, oz.	2123
Bullion retorted, oz.	783
Mercury recovered, oz.	1326
Melted bar, oz.	571
Assay of bullion, gold-fineness	840
Silver-fineness	63
Total value	$9933.38

The low tonnage is due to scarcity of water, but recently, in opening a new level, it appears that this difficulty has been overcome.

Considering that this ore, coming as it does from a depth of 400 ft., is crushed through 30-mesh only, it would seem that the above recovery by amalgamation is remarkable. Steam is the power now in use, but plans are being made for the installation of electric power from the Juan de Haro river, distant about two miles from the mine, where surveys and water measurements show 200 hp. available at low water.

SELF-HARDENING STEELS.

*In high-speed steel practice, the disposition on the part of users as well as makers, has been to use one steel for all purposes, tools for cutting hard as well as soft materials (wood among the rest), forming dies, crushers or hammers, rock-drills, and all the rest of the category of tools. Most manufacturers make extravagant claims for universal high efficiency on behalf of their particular steels. It is true that some steels on the market come pretty near fulfilling the various conditions requisite to universal service, not only making good cutting-tools for hard and soft metal and wood, but being suitable also for forming dies, crushing-tools, hammer-tools, and the like. For the most part, however, the high-speed steels now on the market are adapted to particular rather than to general service. Thus a steel highly efficient in cutting hard material often is not so on soft; and one well suited to cutting is not very likely to be well suited to forming dies. One steel said to be superior to any other in all kinds of metal cutting has the composition:

	%	%
Vanadium	0.32	0.29
Tungsten	17.81	18.19
Chromium	5.95	5.47
Manganese	0.07	0.11
Carbon	0.682	0.674
Silicon	0.049	0.043
Sulphur	....	....
Phosphorus	....	....
Iron (presumably)	75.119	75.223

Though nothing is said as to its efficiency in tools other than those for metal cutting, the composition of this steel indicates that it is also good for all tools requiring toughness and wearing quality; so that it may fairly be classed as an all-round steel. Other things equal, it would be highly desirable to have in a shop one all-round steel equally and in a high degree efficient in all sorts of work. The need for so many varieties of tool-steel heretofore has been a source of great inconvenience, of frequent mistakes, and untold annoyance, all which would be dissipated could a single steel be economically substituted for the many varieties now in use. Steels have recently been put upon the market, at prices greatly below those asked for the ordinary grades of high-speed steel, which are especially adapted to some particular class of work, as wood-cutting, for example. These steels are stated to be intermediate between the high-speed and ordinary steels, and evidently are developed from the ordinary self-hardening steels by varying the alloy-content so as to secure the highest degree of toughness and edge-holding quality, essential to tools not expected to stand up to the kind of work required of high-speed tools, rather than red-hardness, which is not essential to this class of tools. They purport to fill a gap which has been recognized ever since high-speed tools first came into general use, furnishing a tool possibly slightly less lasting in service, but at a considerably lower cost. The precise field for these steels remains to be determined. Doubtless they will come largely into use for wood-working and such metal-working tools as require keen edges, but work in such a way (perhaps at slow speed) that they do not get hot enough at the cutting edge to need a high degree of red-hardness. Some of them are stated to be especially adapted to use in forming and blanking dies, drop dies, and like tools, which require great wear-resistance, but which also generate no great amount of heat while at work. The minute structure of high-speed steel, as seen in a fracture, does not differ greatly from that of carbon steel. It is, in general, seen to be of a fine and uniformly granular appearance, with the granules smaller and more uniform, generally, than those of carbon steel. In annealed and forged high-speed steel the smoothness of structure is increased; and when hardened, the crystalline structure stands out clearly though the individual crystals are very minute. Under the microscope the structure is seen to be essentially that of carbon steel with certain modifications or additions. Pearlite is found, though generally in smaller proportion than in carbon steel, and martensite (or hardenite) forms a considerable proportion in many cases. This is true, as might be expected, especially of those steels which are high or moderately high in carbon, and which therefore are quite hard. Austenite is nearly always present in high-speed steel which has been heated beyond the higher critical point, and of course indicates that the steel is tough in proportion to the amount present. Changes in appearance and in structure due to hardening, tempering, and forging, are as noticeable in high-speed steels as in carbon steels.

*Abstracted from *Engineering Magazine.*

Each nominal horse-power of boilers requires about 1 cu. ft. of water per hour.

CYANIDATION OF SILVER ORES.

Written for the MINING AND SCIENTIFIC PRESS
By D. MOSHER.

The object of this paper is to direct the attention of cyanide operators to possibilities still lying dormant in this field and to the necessity for methods that will give a greater range in the treatment of low-grade silver ores by cyanidation. The situation at present as shown by Caldecott,* Hoffman, Hobson, and other specialists is, that although progress has been made in the cyaniding of silver ores, the results on the whole show that not only is the extraction generally poor, but that the cyanide consumption is usually heavy, while the time is so unduly prolonged as to enormously restrict the capacity of plant, thereby increasing the cost of treatment. It is true that 'sliming' methods have improved results, but the remedy in my opinion will be found in the chemical, rather than on the mechanical, side of the problem.

The causes that tend to impede the efforts of the cyanide operator in the extraction of silver from its ores are, the silver present in a metallic condition, the silver sulphide, and the refractory antimonial group of silver minerals, such as pyrargyrite, stephanite, proustite, and polybasite. The insolubility and inertness of these silver minerals to ordinary oxidizing agents is well known; the fouling of the cyanide solution by the formation of soluble sulphides is generally understood, as well as the bad effect on the extraction of the gold and silver in the ore. The haloid silver minerals, such as bromyrite, cerargyrite, iodorite, and embolite, give the highest extraction according to the following equation:

Primary reaction:

$$AgCl + KCy = AgCy + KCl.$$

Secondary and final reaction:

$$AgCy + KCy = AgK(Cy)_2.$$

It is seen that the haloid silver minerals form ideal compounds for successful cyanidation, while the raw sulphide minerals are less docile. The chemical reactions involved in cyaniding the latter are complex, interfering with the solution of the silver, and therefore resulting in poor extractions. The time required to effect solution is unprofitably prolonged, because the reactions, as already stated, are diametrically opposed to each other. The formation of soluble sulphides (K_2S, KHS) as well as the double sulphide salts of antimony ($SbS_3.K_3$), and ($SbS_4.K_3 + H_2O$) Schlippe's salt, which also are very soluble, prove extremely detrimental in the cyanidation of silver ores. The indirect formation of sulpho-cyanide may also be noted, and it affects the extraction unfavorably. To some extent these difficulties are overcome by the use of lead acetate.

Cyanide compounds are of delicate chemical structure, are easily broken up by oxidizing agents, and are rendered useless as solvents for the precious metals. The one exception is ferri-cyanide ($K_3Fe(CN)_6$). This salt, however, is not very effective.

*MINING AND SCIENTIFIC PRESS, March 28, May 2, and Aug. 29, '08.

Cyanide combinations of the heavy metals as Hg (univalent) and Cu (both univalent and bivalent) react with silver sulphide in accordance with the following equations:

Mercury.—$Ag_2S + Hg(Cy)_2 = 2AgCy + HgS.$

The mercuric sulphide, it is claimed, remains insoluble and inert in the tailing.

Copper.—With copper the reaction is similar to the above, but is greatly enhanced by the addition of ammonia to the copper-potassium cyanide solution. The enormous increase in solvent-efficiency for silver after adding ammonia to the cupro-cyanide solution, is in a measure due to the powerful affinity of the copper-ammonia solutions for oxygen, which in practice is introduced by air-agitation. Another point of value is the stability of these copper cyanides in ammonia. They also react readily with the silver sulphide to form silver cyanide and sulphides of copper, that in ammonia oxidize with the greatest rapidity and are thus re-generated. The addition of lime, $Ca(HO)_2$, to the solution will continually withdraw the products of oxidation in the form of gypsum. The copper-ammonia solution containing a sufficient number of pounds of cyanide per ton acts powerfully on the base sulphide silver minerals, and will dissolve the silver from the ore to a greater extent and with less loss of cyanide than would be possible by the use of plain cyanide methods. Due to the immediate oxidizing action, purification of the solvent and the re-generation referred to, is quickly effected. In my new ammonia-cyanide process, calcium cyanide is to replace ordinary cyanide with the object of reducing the cost to one-fifth of what it is at present.

In the efforts made in past years to effect a greater saving of silver, various oxidizing chemicals have been added to the cyanide. The remainder were not employed either for commercial reasons or for lack of technical insight. They are: Potassium ferricyanide, potassium or sodium bichromate, sodium dioxide, barium dioxide, bromo-cyanogen, potassium permanganate, chloride of lime (hypochlorite), hydrogen peroxide, potassium cyanate (KCNO), hydrated manganese dioxide, ammonium persulphates, potassium percarbonates, chlorine, oxygen, chlorine peroxide.

In the treatment of argentite ores these oxidizing chemicals may be highly effective if used judiciously. Most promising of the above group are the peroxides. Sodium as well as barium dioxide can now be obtained at low cost; sodium dioxide with 20.5% available oxygen is now worth about 40c. per lb., and if the demand becomes greater can be produced for less than 15c. Barium dioxide with 8% available oxygen is worth 8c. per lb. These reagents are to be applied to slimes of clean silicious ores as follows: to a 5% sulphuric acid solution, cooled to the freezing point, add the sodium dioxide in small quantities at a time, avoiding effervescence, as this causes decomposition of the peroxide. The almost neutral hydrogen peroxide produced is to be added to the cyanide, the amount of the addition to be gauged by the quantity of sulphur which will inter-

act with the cyanide and be oxidized to sulphate. By using correct ratios of cyanide and peroxide an equilibrium will be established where no decomposition of the cyanide will occur, and at which point no sulphides will tend to foul the cyanide solution. With barium peroxide a similar method of producing hydrogen peroxide is in vogue, although it is recommended to add it direct in the cyanidation of ores, I prefer hydrogen peroxide. The idea is, that for silver extraction the hydrogen peroxide must be carefully made under ice-cold conditions or no satisfactory results can be expected. The addition of sodium dioxide direct to cyanide with the above object in view is generally a useless proceeding, due to lack of caution in the temperature employed.

TABLE SHOWING COSTS OF OXIDIZING AGENTS.

Chemical product.	Available oxygen, %	Cost, cents per lb.	Cost, efficient oxygen, per lb.	Remarks.
Sodium di-oxide Na_2O_2	20.5	40	2.00	
Barium di-oxide BaO_2	8.0	8	1.00	
Hydrogen peroxide $H_2O_2 = 3\%$	1.5	12	8.00	
Potassium permanganate $K_2Mn_2O_8$	12.7	10	0.80	
Sodium bi-chromate $Na_2Cr_2O_7$	17.9	7	0.38	
Calcium hypochlorite $CaOCl_2$	7.4	1.25	0.17	
Potassium ferri-cyanide $K_6(Cn)_{12}Fe_2$	...	35	...	Indirect agent in oxidation in presence of alkali.
Ozone (O_3)	...	10	1.10	8 lb. per kw.-day in form of ozonized air.
Chlorine (Electrolytic)	...	4	...	Not crediting caustic soda produced at the cathode.
Ammonium persulphate $(NH_4)_2S_2O_8$	7.0	60	8.40	
'Linde' oxygen	96-98	30	0.30	With 'Linde' apparatus, cost of 96 to 98% will be 2c. per pound.
Chlorine peroxide Cl_2O_2	31	35	1.14	

Of the permanganates, either calcium or potassium permanganate may be employed, but best in a neutral or alkaline solution and separate or distinct from the cyanide solution, which they would quickly decompose. The best manner of using the permanganates would be in a hot solution, agitating the silver-bearing slime with them while passing steam into the silver-slime tank until decolorization had completely taken place, then pumping the cooled slime to a cyanide tank and dissolving the silver out with cyanide. Manganous salts, as stated in former papers, are injurious in cyaniding silver ores. This is not the case, however, with manganic oxide, (MnO_2), which is a powerful oxidizer, and is applied in the Adair process. Bichromates are claimed to have given good results in the cyaniding of silver ores through the addition of the oxidizing agent direct to the cyanide. This salt is a mild oxidizing agent, and as such may be useful in some cases. The persulphates have also been tried with the same object in view as well as the percarbonates. If it were not for their cost they would prove valuable. On a large scale ammonium persulphate ought to be produced by electrolytic processes for less than 10c. per pound. I come to the conclusion, however, that the solid oxidizing agents, with the possible exception of the hyperchlorites (chloride of lime), are costly and only to be applied where their consumption is a fraction of that of the cyanide. Air or even oxygen has very slight oxidizing value at the ordinary temperature, and may therefore be dismissed. In view of the development of the electric discharge methods for generating ozone (O_3) which now can be produced at trifling expense, it is surprising that its application as an oxidizer in cyanide treatment has not made greater progress. In the form of ozonized air in which 1 lb. of ozone will require 3 kw. hours to produce it, the cost per pound figures out at about 10c. The system of its production is simple and outside of the original ozone plant does not require a change from modern air-agitating apparatus, which finds its latest application in the Pachuca tank. Ozone is much more effective than the peroxides, and the results with it in cyaniding silver sulphide ores are highly promising.

The most powerful reagent, however, for disrupting and decomposing the group of antimonial-silver minerals without roasting the ore to make them amenable to cyanide, is chlorine. This can be produced economically, together with the neutralizing alkali, by means of the electrolytic chlorine cell. One of the cells, prominent at this time is the Townsend. It is successfully operating at Niagara Falls and other centres, and has also been adopted in some gold chlorination mills. The following data will show the capacity of these cells, their output of chlorine and caustic soda direct from salt brine per 24 hr., the cost of the cells, and the approximate cost of producing the chlorine. The method to be applied in treating antimonial-silver ores by means of electrolytic chlorine is to first slime the ore and in an acid-proof tank, treat the pulp heated by steam, by passing the chlorine into it, until tests indicate that the silver minerals have been thoroughly broken up and the silver transformed into chloride. The antimony and arsenic present will also be converted into chlorides while sulphur will separate out and will subsequently only slightly affect the cyanide. The acid compounds formed in the chlorinated pulp will then be neutralized by adding enough of the caustic soda solution produced at the cathode compartment of the cell, sufficient of the soda being added to thoroughly neutralize and render alkaline the silver-ore pulp. After this treatment the ore will have reached a suitable condition on cooling for ordinary cyanidation. I suggest that a preliminary washing out of the salts remaining in the pulp through this preparatory treatment may be of value in some instances, prior to the final cyanidation.

One of the simplest reactions involved in decom-

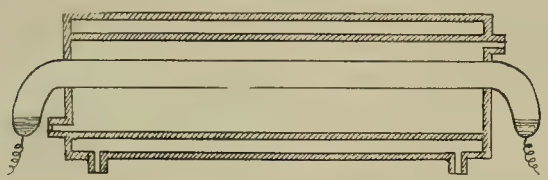
posing antimonial-silver minerals by means of chlorine may be expressed as follows:

(Pyrargyrite):

(1) $(Ag_2S)_3Sb_2S_3 + 12Cl = 6AgCl + 2SbCl_3 + 6S.$

(2) $2SbCl_3 + 6NaOH = Sb_2O_3 + 3H_2O + 6NaCl.$

The group of antimonial-silver minerals, is slimed, cannot resist the decomposing effects of chlorine, especially on warming the liquid in which they are suspended, as already shown by Hoepfer, Borchers, Kopp, and other experimenters in electro-metallurgy. Their method, however, was to extract the metallic chlorides formed, as such, by means of brine or calcium chloride, while I propose to use chlorine only as an intermediate means, that is, prior to the final cyanidation. Electrolytic chlorine, due to the low price at which it can be produced at present, offers the simplest solution of the silver cyaniding problem, as it produces the neutralizing agent, namely, caustic soda, at the same time and without any extra expense, and in proportion sufficient to balance the acid compounds formed in the first instance. The gold present in the ore will also be attacked by the chlorine and will the more readily dissolve later in the cyanide.



Apparatus for Producing Ozonized Air.

TABLE SHOWING CAPACITY AND OUTPUT OF TOWNSEND ELECTROLYTIC CHLORINE CELL PER 24 HR.

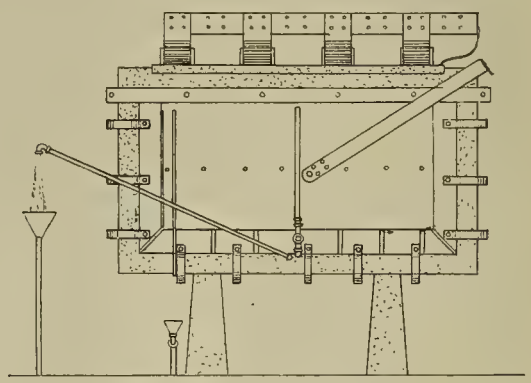
(Standard 2500 Ampere Cell at 4½ Volts.)

Chlorine, lb.	Caustic soda, lb.	Power required.	Chlorine per hp. lb.
156	177	11¼ kw. or 15 hp.	10.4

Estimating power at ¾c. per horse-power hour, the chlorine will cost approximately per pound for power 18c., for salt (at $10 per ton) 1c., for attendance and repairs 1.2c.; total 4c. The caustic soda produced as a twin product is not credited in the above figures. The 2500 ampere cell has the following dimensions: height 3 ft., width 12 in., length 8 ft., and it is constructed mainly of cement concrete. The cost of cell is $575 f. o. b. New York. Townsend cells having 4000 and 6000 ampere capacities have also been constructed and recently placed in operation at Niagara Falls.

In concluding this article I wish to affirm that in both ozone and chlorine will be found the powerful and cheap re-agents which are certain to aid in solving the problem of silver cyaniding. Two economic factors, however, will present themselves, and I must affirm for chlorine, first, that with ores carrying only a small per cent of pyrite, or for those out of which a preliminary concentration has removed the larger proportion of base sulphides, that the chlorine consumed per ton will not exceed the cost of roasting or chloridizing. In most instances it will only reach a few pounds of chlorine per ton of ore or tailing treated. Second, with acid-proof, alkali and chlorine-proof brick-lined tanks, no trouble need be anticipated in the effort to thoroughly attack the silver-bearing minerals by chlorine, and in an ore-pulp heated to 120-150° F.

Ozonized air is now used industrially in a large number of chemical industries and particularly in the purification of drinking water. Its cost of production is being reduced to such an extent as to make its application in silver cyaniding a very small factor in the total cost of treatment. A large number of forms of ozoning apparatus have been patented. One of these in successful operation in a number of works produces 155 gm. of ozone (O_3) in the form of



Townsend Electrolytic Chlorine Cell.

ozonized air per kw. hour, of 8 lb. per (24 hr) kw. day. In the cyanidation of silver, where the ore assays on an average 20 oz. per ton the oxygen required would be one-fifth of this, or 4 oz. For 100 tons of ore per day this would equal a total of 400 oz. of ozone, or 25 lb., which in practice would be met by a 4 to 5-hp. ozone-producing apparatus.

The reaction of silver sulphide with ozone and cyanide may be stated:

$$Ag_2S + O_3 + O = Ag_2SO_4.$$

$$Ag_2SO_4 + 4KCy = 2KAgCy_2 + K_2SO_4$$

Only ordinary cyanide apparatus will be required in the use of ozone, that is, no brick-lined or acid-proof tanks are needed, as is the case when chlorine is to be applied.

The importance of manganese in the manufacture of steels of all kinds, and its influence upon high-speed steel in combination with tungsten is very great. Like nickel and chromium, manganese seems to hinder the formation of the double carbides of tungsten and molybdenum. Steel containing these elements in combination with a sufficient proportion of manganese (or of nickel or chromium), therefore are self-hardening without the high heat treatment, though they are not necessarily high-speed to any considerable extent, even when they receive that treatment. Very high manganese makes steel cold-short (brittle when cold) and susceptible to fire cracking.

SYSTEMS OF CHARGING FOR ELECTRICAL ENERGY.

By W. T. Ryan.

*Within the last few years systems of charging for electric current have been widely discussed. The principal ones in use at the present time may be classified as follows: 1. Flat rate. 2. Meter. 3. Classification of rates. 4. Wright maximum-demand system. 5. Doherty rate. 6. Four C system. 7. Double-rate meter. 8. A charge based on the customer's minimum monthly guarantee. 9. Combinations of the above.

1. The flat-rate system. Many companies supply current at a certain price per month per lamp. This works out to rates per kilowatt-hour, varying from a minimum where the current is used continuously to a maximum of infinity where no current is used. This system is popular because the customer knows just how much he will be called upon to pay. Bookkeeping is simplified, and the cost of meters is avoided, but the rate is unjust and void of business principles.

2. The meter system. This system to many customers appears equitable. An analysis shows a fixed charge per unit of energy sold, regardless of capacity demand. In this case the 'cost to produce' varies from low per kilowatt-hour, if the total capacity be used continuously, to infinity if no energy be used. The system is as absurd as the flat-rate system; neither bears any relation to the cost of service. If as much as $1 per kilowatt-hour were charged some customers, their total payment would still be so small that it would not equal the cost of reading their meters, keeping books for their accounts, and the core-loss of transformers, to say nothing of the interest, depreciation, taxes, and insurance on the money invested in apparatus.

3. Classification of rates. A common method is to classify customers according to their daily use of current, and to establish a separate rate per kilowatt-hour for each class. There are two distinct classes of service in most electric plants, namely: (a) domestic lighting, with its negligible demand during the day and its excessive demand for current during the evening; (b) motive-power service, with a nearly uniform demand. Customers of the first class are charged at a higher rate than those of the second class. In addition to those differences in the scheduled prices, quantity discounts are often given, and in many cases there is also provided a minimum charge to meet interest on the cost of the watt-hour meter, cost of reading it, and a portion of the cost of the station bookkeeping.

4. Wright maximum-demand system. No adequate method of storing electrical energy economically is in existence. This necessitates keeping in readiness, at all times, the apparatus of the station, which is loaded to full capacity for only a short interval each day during the busy part of the year. This requires a corresponding investment, on which a reasonable return for interest, insurance, depreciation, and taxes must be obtained before any profit can be made. On the straight meter rate, or even with a classification of rates, it is practically impossible to charge the short-hour customer a sufficiently high rate to cover the expense. A number of systems intended to make each customer pay in proportion to the 'cost of service' have been devised. Arthur Wright, of England, divides the cost of electrical energy into (a) preparation costs, (b) production costs. The preparation costs are again subdivided into (1) formation expenses, (2) stand-by costs, (3) service costs. (a) The 'formation expenses' are those incurred by the necessity of obtaining the initial capital to start the undertaking with. The 'stand-by costs' represent the maintenance of the plant and supply-mains in a condition ready to supply and distribute energy. The 'service costs' represent the maintenance of service wires and meters, the incidental disbursements connected with accounts, complaints, and collections. (b) The 'production costs' represent the actual expense of supplying and distributing electrical energy. This varies with the amount of energy generated and distributed. The unit of production cost is the 'increment of expenditure' incurred by making a given plant and set of mains supply an extra unit of electrical energy. The system assumes that each customer should pay the fixed charge on the portion of the plant he uses, and in addition should pay the running expenses only for the hours he actually uses the plant. The Wright maximum-demand meter, which records the maximum current used by a customer between two readings, is read at the same time as the watt-hour meter. These readings show the amount of energy to be charged for at a high rate, and the amount at a low rate. Other methods which are sometimes used are: (1) by putting the demand equal to the connected load; (2) by estimating the demand; (3) by limiting the demand so that a customer cannot exceed a certain amount; (4) by measuring the demand. The advantages and disadvantages of these methods are as follows: (1) Connected load; no maximum-demand meters; demand fixed in advance; unfair basis; notifications and inspections necessary; inaccurate determination; large connected load discouraged. (2) Demand estimated: fair basis; no maximum-demand meters; demand fixed in advance; notifications and inspections necessary; inaccurate determination; large connected load discouraged. (3) Demand limited: fair basis; notifications and inspections not necessary; accurate determinations; large connected load not discouraged; instruments necessary. (4) Demand measured: fair basis; notifications and inspections not necessary; accurate determinations; large connected load not discouraged; instruments necessary; demand not fixed.

The charges may be arranged in several ways. One method is to charge a list price per kilowatt-hour, and then give discounts to customers who average two or three hours per day use. Another method is to charge a fixed amount per year, payable in twelve installments as rent on the investment. In addition, a charge of 3 or 4c. per kilowatt-hour would cover the running expenses. The most common method is to charge, say, 12c. per kilowatt-hour for the 60

*Abstracted from the Engineering Magazine.

hours (2 hours per day), and, say, 4c. per kilowatt-hour for the remainder.

5. Doherty rate. According to Henry L. Doherty, the costs are fixed: (1) by the number of customers; (2) by the distance of the customers from the station; (3) by the capacity they demand; (4) by the amount of their consumption. There would seem to be no reason for varying the cost to different customers because of distance from the station, except in extreme cases. Certain costs are entirely fixed by the number of customers. To cover these there should be a fixed charge for each customer. Costs such as interest, insurance, depreciation, and taxes, which are fixed by the capacity demanded, are covered by a 'stand-by' charge. Still other charges are fixed by the quantity of current generated, such as fuel, oil, lamp renewals, etc. To cover these there should be a fixed rate per kilowatt-hour consumed. The maximum demand on a station is usually from one-third to one-half the load connected. The cost of the station and the lines leading from it usually lies between $200 and $600 per kilowatt installed. A fair value for the stand-by charges, which include interest, insurance, depreciation, and taxes, would be 12%. A fair value for the fixed charges, which include office expenses, reading meters, rendering bills, etc., would be, say, 3%. If the plant costs $400 per kilowatt installed, and the maximum demand is one-half the connected load, the annual stand-by charges plus the fixed charges would be $30 per connected kilowatt. If a customer uses 50-watt lamps, the annual stand-by charge, plus the fixed charge per 50-watt lamp connected, would be $30 divided by 20, or $1.50. This would be 12½c. per month per equivalent 50-watt lamp connected, whether the customer uses any power or not.

6. Four C system. This system involves a capacity charge and a current charge—four Cs. The average cost of capacity of the plant is found by the formula: $C = \frac{F}{N}$, in which F = fixed charges per annum on unit cost of plant; N = number of 50-watt lamps per unit; C = average capacity charge per annum per lamp. After obtaining the average capacity charge, a maximum and minimum charge per lamp is determined on a sliding scale. In this system the fixed charges include all except production costs, and are apportioned among the various customers in proportion to the length of time they use energy. Any system which charges as much rental to a short-hour as to a long-hour customer discourages the growth of the industry. While it is consistent to expect the customer to reimburse the station for fixed charges necessary to furnish the service required, this is necessary only to insure the station against loss in carrying capacity for him. It is not necessary or desirable to charge the full amount in order to get this protection.

7. Double-rate meter. The double-rate meter is an ordinary watt-hour meter, equipped with two sets of dials and a clock which throws into gear one set during the period of excessive loads and another during the remainder of the 24 hours. The customer is charged a high rate per kilowatt-hour for the energy indicated by the first set, and a low rate for the energy indicated by the second. Such a system promotes long-hour consumption. An ordinary meter may be used by inserting a resistance in an auxiliary circuit at the central station, when the low rate is to begin, and maintaining it until the end of the period. This retards the meter to a degree representing the ratio the low rate bears to the high rate. This method reduces expense, but has the disadvantage of not being easily understood by the average customer. The chief difficulties are the absence of suitable mechanical appliances by which two meters or two sets of dials can be controlled in such a manner as to protect the company against fraud, secure accuracy, and avoid increase in fixed charges. While this method tends to broaden the peak, it also tends to reduce the use of light in the business districts at a time when the rate would be doubled or tripled.

8. A charge based upon the customer's minimum monthly guarantee. In a recent bulletin published by the Union Electric Light & Power Co. of St. Louis a novel system of rates is explained. Under it the service is divided into a large number of classes, and each customer in the same class gets the same rate. The rate is based on the minimum monthly guarantee the customer is willing to make per horse-power or per 50-kilowatt lamp connected. The rate is also lower the larger the connected load. The power rates are on the same plan. A customer whose connected load is one horse-power pays 10c. per kilowatt-hour if he guarantees $1 per month per horse-power. If he guarantees $7.50 per month per horse-power, he pays 5c. per kilowatt-hour. There are a number of intermediate steps between the 5 and 10-cent rates, depending on minimum monthly guarantees. This system has marked advantages. It is difficult for customer A to say that there is discrimination in favor of customer B, for if A will connect the same load and make the same guarantee as B, he will get the same rate. It strongly encourages larger connected loads and longer hours use of both light and power by all customers at all times.

9. Combinations of the above systems. Many central-station managers find it necessary to work out systems which are combinations of two or more of the above. It is very difficult to work out a system of charging for electrical energy which will be fair and equitable, easily understood by the layman, and at the same time induce all customers to increase their consumption economically to themselves and with profit to the generating company.

With the aid of titanium it is said to be possible to make better rails from bessemer converter steel than without its aid from open-hearth steel. With the aid of titanium it is possible to eliminate blow-holes. It is further possible to remove the brittleness and increase the durability of chilled-iron car-wheels, and further, to improve nickel steel, chrome and nickel, and other steels.

Tests by the Brinell method show that chilled cast-iron treated with titanium is harder than the untreated metal, although the chill is reduced by the alloy, and yet gray iron back of the chill is readily machined, such as hubs of car wheels and the like.

CENTRIFUGAL PUMP EFFICIENCY.

Written for the MINING AND SCIENTIFIC PRESS
By V. V. MESSER.

The simple principle involved in the construction of a centrifugal pump is the great argument in its favor. Invented about half a century ago, the centrifugal pump retains the form originally adopted by the inventor; the evolution of the pump always has affected details of construction only. Latest developments of centrifugal pumping machinery with hard-metal wear-resistant liners have made it possible to use centrifugal pumps for handling extremely gritty liquids, and the most modern metallurgical practice indicates that tailing wheels and elevators are doomed to give way to centrifugal pumps for elevating sand and tailing. Finally, the advent of multiple-stage centrifugal pumps has broadened their field of usefulness, so that even now the most approved types of plunger pumps find a formidable competitor in the multiple-stage centrifugals.

It is impossible to obtain exact figures as to the number of pumps in use in this country, most of which are designed by practical builders by rule of thumb, or are copied blindly from a pattern of some of the so-called standard makes. Consequently, the efficiency of the average pump is invariably low. Figures as to the money wasted in this country annually by ignorance in the building of pumps would give simply appalling results.

An inefficient pump is an expensive machine, even if the first cost be nothing. Indeed, the first cost is an insignificant item when placed beside the cost of power required to run it during its life. For example, suppose a 2-in. pump of low efficiency is bought at a cost of $50. Suppose 2 hp. be required to run it, and that the cost of power is $12 per hp.-month. At the end of five years $1440 will have been spent for power. Comparing the cost of the pump with the cost of power, we find that the first cost was only 3.3% of the total expenditure.

	30	35	40	45	50	55	60	65	70	75
#	200.00	171.43	150.00	133.33	120.00	109.09	100.00	92.31	85.71	80.00
30	0	28.57	50.00	67.67	80.00	91.91	100.00	107.69	114.29	120.00
35		0	21.43	38.10	51.43	62.34	71.43	78.02	85.71	91.43
40			0	16.67	30.00	41.00	50.00	57.69	64.29	70.00
45				0	13.33	24.24	33.33	41.03	47.62	53.33
50					0	11.00	20.00	27.69	34.29	40.00
55						0	9.09	16.67	23.81	29.09
60							0	7.69	14.29	20.00
65								0	6.59	12.31
70									0	5.71
75										0

Table Showing Cost of Pumping 1000 Gal of Water per Minute in 30 Days.

The upper horizontal row of figures in the accompanying table gives the cost in dollars and cents of running a 6-in. centrifugal pump delivering 1000 gal. of water per minute against a head of 20 ft., with different pump efficiencies, ranging from 30 to 75%, assuming that the cost of power is 2¼c. per 1 kw.-hr., or $12 per hp.-month. These figures are of course arbitrary. It is a simple matter to arrive at the cost with different heads, cost of power, etc., since the cost will vary in direct proportion. The figures given represent a fair average for power at a great number of mines.

The triangular table gives the saving effected in 30 days by using a pump of higher grade. To compute this, find the efficiency of a pump of the higher grade in the upper row and that of the lower-grade pump in the vertical column; follow their respective lines vertically downward, and to the right horizontally, until they meet; the result will be the saving effected in 30 days of continuous pumping under conditions mentioned. Thus a 60% efficiency pump would save $50 in 30 days over a 40% pump. The table also shows that a 40% efficiency 6-in. centrifugal pump consumes $150 worth of power per month to deliver 1000 gal. of water per minute, which is little below the first cost of a standard 6-in. pump.

An ideal centrifugal pump would be a machine in which the molecules of liquid enter the pump-casing at a slow speed and are then accelerated gradually

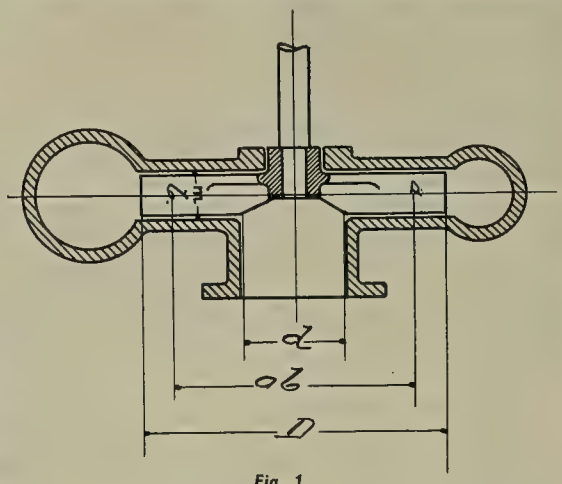


Fig. 1.

to such a velocity that they would acquire momentum to rise to the delivery point, losing all this momentum through the force of gravity on their travel up the discharge line, at the terminal point of which they would leave it with no velocity. The simplest mechanical analogy is a solid body thrown upward in a vertical direction. Its momentum will be absorbed by the force of gravity, and finally, when all of the energy has been absorbed, the body will come to rest at the highest point of its travel. If that point be the height to which the body is intended to be lifted by the machine, that would represent the condition of 100% efficiency.

Evidently there will be different pressures at the circles of different radii on the runner, and ideal conditions require that there be no probable leakage of liquid in a radial direction between two points on the runner of a pump. That supposes absence of friction, which is not attainable. Actually, energy is wasted by the thrashing or churning effect of the runner. Let Fig. 1 represent a typical cross-section of a centrifugal pump. Let D be the outside diameter of the runner in inches; d the diameter of the suction-pipe in inches; m the width of the runner in inches. Then the liquid as it flows through the pump,

instead of being accelerated evenly, is being retarded inside of the casing and 'thrashed'. It is retarded because the cross-sections through which the water passes as it flows in radial directions is invariably greater than the cross-section of the suction-pipe. It takes a certain time for the liquid to pass through the runner. In the case of a runner of equal width (Fig. 1), the time in which liquid passes through the runner is expressed by the formula,

$$T = \frac{\pi m}{4Q} [D^2 - d^2];$$

where T = time; Q = capacity of pump in cubic inches per second; $\pi = 3.1416$; D = diameter of runner; d = diameter of suction; and m = width of runner.

Taking a 3-in. pump, in which D = 14 in., d = 4 in., Q = 850 cu. in. at 700 r.p.m. Using this formula, we have figured that the time required for a molecule of liquid to pass through the runner is 0.33 second. In that length of time the runner will make about 4 revolutions, whereas in a properly designed pump ½ to 1 revolution of a pump would suffice to pass the water through the runner without whirling the liquid and churning it. The frictional effect of the churning plays an important part in the power bill.

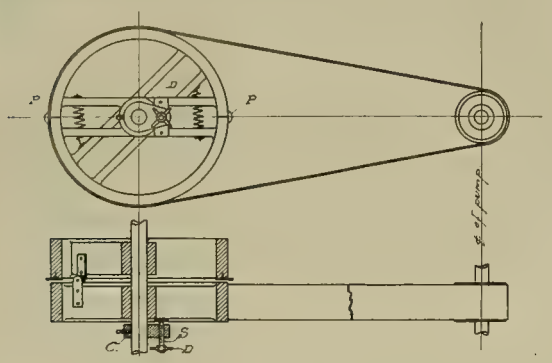


Fig. 2.

Another source of loss in efficiency is the continuously increasing clearance between the runner and the casing. That loss can be decreased by using a hard-metal liner, but that is not a remedy. The wear itself must be taken up. The importance of having the smallest possible clearance between the runner and the casing is obvious, for the reason stated. Nobody would think of running a piston pump having a clearance around the piston, while many a millman would run a centrifugal pump with ⅛ in. clearance on each side of the runner and never think of the continuous power-loss he was occasioning by reason of it.

The centrifugal pump has a special field of usefulness which cannot be filled by any other type, and to get efficiency the runner should be designed for the pressure the pump is to work against. Therefore, the ideal pump should have the runner easily accessible, and the vendor should be prepared to equip each pump sold with a runner designed for the maximum efficiency at the pressure the pump is to work against. It should not be inferred that a runner designed for a 10-ft. lift will not pump against a 20-ft. lift, but it will not develop its full efficiency except when working under the head for which it was designed. A centrifugal pump properly built for a given purpose can be operated so as to develop an efficiency in smaller sizes (3 to 4 in.) as high as 60%, and in sizes larger than 6 in., about 70 to 80%. In general practice, pumps up to 4 in. diam. of discharge are usually developing 30 to 40% efficiency, and larger sizes are doing but little better. There is no simple way of accurately ascertaining the efficiency of a centrifugal pump, but there are many ways of determining it approximately, that is, within 2 to 4%. The following method may be used with practically no special appliances; all that is necessary is a couple of springs, set-screws, and a shaft-collar. First, measure the flow of water pumped, in miner's inches, using 1¼-in. plank, aperture 2 in. wide, centre line of which shall be 6 in. below the surface. The miner's inch, thus measured, will be equal to 1½ cu. ft. per minute, or 11¼ gal., of 93½ lb. of water. Multiply 93½ by the number of miner's inches measured, and by the elevation of the point of discharge above the level of the water in the vessel to which the suction-pipe is connected. The product will represent the theoretical foot-pounds of energy

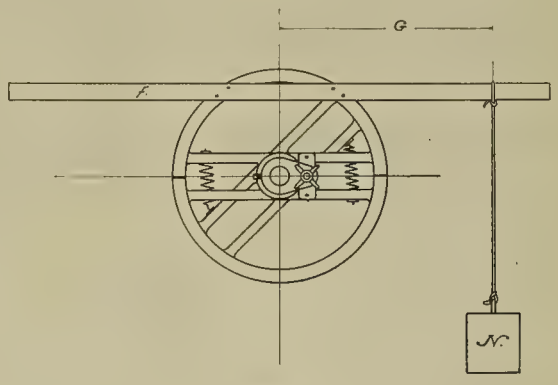


Fig. 3.

necessary to elevate a given amount of water per minute. Now, if we determine the number of foot-pounds of energy actually consumped by the pump, the ratio of the former to the latter, multiplied by 100, will give the efficiency of the pump. If the pump is run by a motor or gas-engine, then by using a watt-meter or Prony brake it is easy to arrive at the figures; but if it is run from a line-shaft, loosen up the driving pulley on the shaft by removing the key or set-screw, put another wooden pulley next to the loose one (Fig. 2), and set the new pulley tight. Then take two tension springs and connect the pulleys by the springs, as shown in Fig. 2. See that the spring-tension be in a direction exactly perpendicular to the shaft; otherwise the tension of the springs will cause side-pressure, which will result in friction between the pulleys, thus rendering the observations worthless. Nail a few pieces of leather, P, on the face of the wooden pulley, and set a metal collar next to the loose pulley. The collar, C, is to be provided with a screw, S, with a catcher, D. When the shaft is turning, put an iron bar in the way of the travel of the catcher, D, which will work the screw and clamp the pulleys together. When the pump is working, the

tension of the belt is taken by the springs, and the loose pulley will be turned on an angle in proportion, or nearly so, to the tension of the belt. Count the revolutions of the shaft. After the shaft has been stopped, mark the relative position of the pulleys, and then slacken the screw, C, after which nail a wooden plank, f, Fig. 3, to the wooden pulley; see that it does not disturb the free balance of the pulley. Nail it in the middle, and then by hanging weights on the plank and turning the shaft and leaving the level, f, horizontal, bring the pulleys to the same relative position they held in relation to each other while the pump was working. Then multiply the weight, N, in pounds, the horizontal distance, G, between the centre of the shaft and the vertical line passing through the weight in inches, by the number of revolutions, and by 6.28, and the result will give the foot-pounds of energy consumed in one minute by the pump. Then figure the efficiency in the manner mentioned above. The 'slip' of the belt, if moderately tight and dressed, will be about 1 to 2%. Repeat the measurement several times to get an average. If your belt runs smooth, the average of three observations will do; if it runs unevenly, which is the case with gas-engine drive, then make at least five to seven observations and take the average.

This method can be used to determine the horsepower consumed by any smoothly running machine. See that the driving pulley does not run too fast, otherwise the centrifugal force may affect the tension of the springs. See also that the springs are as light as possible, but do not overstrain them or inaccurate results will be obtained.

CEMENT PRODUCTION IN 1908.

The total production of all kinds of cement in the United States during 1908, as shown by returns received by the U. S. Geological Survey from all the cement producers of the country, amounted to 52,775,925 barrels, valued at $44,376,656. This total was made up as follows:

	Barrels.	Value.
Portland cement	51,002,612	$43,472,679
Natural cement	1,621,862	808,509
Puzzolan cement	151,451	95,468
	52,775,925	44,376,656

The corresponding figures for the calendar year 1907 are given below for purposes of comparison:

	Barrels.	Value.
Portland cement	48,785,390	$53,992,551
Natural cement	2,887,700	1,467,302
Puzzolan cement	557,252	443,998
	52,230,342	55,903,851

The portland cement production showed a heavy decrease in 1908 as compared with 1907 in most of the Eastern and Southern States, the loss being greatest in Pennsylvania, New Jersey, New York, and Michigan. This decrease in the East and South was offset, however, by remarkable gains reported by plants in the Middle West and on the Pacific Coast. The average price of the entire portland cement output in 1908 was only 85c. per barrel—36c. below the average price in 1907.

PURIFYING SMELTER SMOKE.

*The testimony of E. P. Mathewson in the final hearing before Judge Hunt in the United States Circuit Court of the ninth district of Montana, in the famous smelter-smoke case (Bliss *v.* Anaconda Copper Mining Co.), is of interest. It passes in review the methods available for abating the difficulty. Mr. Mathewson, the manager of the Anaconda Copper Co., testified that the method of cooling by the admission of air into bag-houses is an impracticable way, because the gas in the smoke would destroy the bags as fast as they could be supplied. The bag-house method is successful in lead and zinc smelters, but, owing to the quantities of acid in the fume from copper smelters, it is impossible to prevent the destruction of the bags. He also explained a radiation process, saying that as the methods now employed in the Washoe smelter caught all the particles except the finest, the radiation process would apparently not be effective to catch the particles that are not now being recovered. He also referred to a freezing process, but that could only be used by counting upon a very large product of poisonous mud which could not be left exposed without great danger. Where the quantity of mud produced by this process is small it can be buried, but at the Washoe smelter, owing to the enormous amount which would result, burial would be impossible.

In regard to the electrical discharge method, Mr. Mathewson made it quite clear that, owing to the mechanical difficulties encountered thus far, practical application of the process, as attempted in California, had not been a success, and could not be made effective at the Washoe, where the velocity of the gases is approximately twenty times greater than at the Selby smelter on San Francisco bay. F. G. Cottrell, Professor of Physical Chemistry in the University of California, the inventor of this process, visited the Washoe smelter, and after study of the conditions there was not willing to assure defendants of its success without further experimentation.

Mr. Mathewson also explained the friction or wire process now being constructed at the Boston & Montana copper smelter at Great Falls, Montana. The process consists in suspending thousands of wires from the ceiling of large chambers in such a way as to cause friction of the gases, and thus bring about a settling of the dust. Mr. Mathewson himself doubts the success of this experiment, but says that if its efficiency is demonstrated it will be used at the Washoe smelter. He expects final tests to be made during this year.

Another system explained at the hearing is the filtering of the gases through finely pulverized slag moistened with water. This, the writer said, would also result in the production of immense quantities of poisonous mud, and, moreover, has not been successful in Utah, where it has been tried. The feasibility of decreasing the velocity of the gases was explained. This method, he said, would require the construction of a flue twenty times as great as the

*Abstract from testimony given by E. P. Mathewson, before the U. S. Circuit Court in Montana.

present Washoe flue to decrease the velocity to 60 ft. per minute. By this device the product recovered would be dust, but, comparatively speaking, the excess over that now saved would be so slight as not to make the process worth serious consideration. The use of centrifugal gas-cleaners was mentioned, but that process would also mean the accumulation of great masses of acid-mud, and thus involve the same problem of its disposal. Mr. Mathewson closed his testimony by saying that the result of his own study and of the extensive investigations and experiments made by engineers and scientists in Europe and America in behalf of the defendants, is that the Washoe company has a system nearer perfection than any other yet devised for the purpose of treating arsenic fumes. He added, however, that he knew the system was not perfect, and that the defendants were still experimenting and would continue to study the question.

BLASTING AND PREPARING THE SHOTS.

Written for the MINING AND SCIENTIFIC PRESS
By DENNIS H. STOVALL.

I know a mine superintendent who has made it a practice to question every miner he employs regarding his familiarity with blasting. Moreover, he gives them instruction when necessary, in this important matter, and he maintains a uniform system. By exercising a little care he has had few accidents. This is a feature of practical mining to which every superintendent and manager should give attention.

Few miners use any explosive other than dynamite, though some still cling to black-powder, especially those working in soft ground. Some large companies still use black-powder, believing it more economical and safer. Whether it be safer or not depends much upon the way in which it is used. It requires more tools and considerably more time to prepare a shot with black-powder than with other common explosives, but the results are satisfactory if the powder be carefully set and well tamped. The tools needed are a pricker or needle, which is a slender tapering rod of copper or bronze, used for maintaining a hole in the tamping through which the charge can be fired; the tamping bar, which is a rod of iron, copper, or bronze, or of iron shod with copper, and used for ramming in dried clay or pounded slate, to hold the powder firmly; and a claying bar, used for lining wet holes with clay, to render them temporarily water-tight.

Where loose powder is used, the ordinary method is to set in the pricker, holding it upright in the centre of the hole while a portion of the charge is poured in. Care is taken to draw out the needle as the tamping proceeds, so as to obviate too much exertion being required for its final withdrawal. The small hole left in this way serves for the insertion of the fuse, or of the quill or straw filled with powder, which is pushed down and connected with the fuse proper. The best and surest method, however, is to push the fuse itself well down into the hole. As the safety-fuse burns slowly, not faster than two or three feet per minute, the miner has ample time for retreat, by allowing sufficient length. It is usual to light the fuse by a candle-end fixed under it by a piece of clay, considerable time being required for the candle to burn through the fuse.

Most modern high explosives contain nitro-glycerine in some form, the explosion being brought about through the action of a fulminating cap. Gun-cotton is employed extensively in western mines, and is prepared in various forms, the cotton fabric itself being always mixed with some nitrate or mixture of nitrates. Gun-cotton is more powerful than gun-powder, though less powerful than dynamite; it possesses an advantage over the latter, however, in that it does not have to be thawed in cold weather. It can be handled with greater safety than dynamite, but is just as dangerous when remnants are left in partly exploded charges. The miner should examine the bottoms of all holes after blasting, and destroy any remnants of powder by firing a detonator in a 'socket' or missed hole which cannot with certainty be pronounced free from danger.

The methods employed for firing gun-cotton, cotton-powder, blasting gelatin, dynamite, and all explosives containing nitro-glycerine, are practically the same. The explosion is induced by the detonation of a fulminating cap. This fulminating cap contains fulminate of mercury with chlorate of potash, and it is fastened into the safety-fuse by squeezing with a pair of nippers. It is then inserted into a small cartridge, or primer, of the explosive, and placed above the charge proper. Some miners who use gun-cotton prefer to lightly tamp in a small charge of gun-powder above the cotton, firing it through this.

The common stick-dynamite has several advantages over other forms of explosives. It has greater power, may be used in wet holes or under water, is effective in ground which is full of cavities, and it requires no tamping. Being plastic, because of its mixture with wood-pulp, it readily adjusts itself to completely fill a hole after it is placed. The greatest disadvantage of dynamite is that it must be thawed in cold weather, but where care is exercised this can be accomplished with comparatively little danger. There is also its freakishness, by which entire sticks fail to explode through the action of the fulminating cap, but may later ignite with fatal results when struck with a bar or drill. The danger is enhanced when remnants have been left in contact with water, as the liquid causes a separation of the nitro-glycerine from the dope, so that even a blow upon the adjacent rock leads to an explosion. A small quantity of the nitro-glycerine leaked into a crack is sufficient to cause death and destruction.

Firing several holes simultaneously by electricity eliminates much danger. There has been placed upon the market an igniter by which a number of instantaneous fuses convey fire to as many separate holes. The charges are fired, either singly or simultaneously by electricity, the electric charge being obtained from a magneto dynamo or battery. The distinct advantage of this method of firing is its safety, as the miner can retire to a perfectly safe place, and all the miners can reach a place of safety before a single shot is exploded.

ANTHROPOMORPHISM IN PETROGRAPHY.

By Edward K. Judd.

*If some of you have been casting curious glances at that word 'anthropomorphism', perhaps you have suspected that it was a misprint for 'metamorphism', which is a better known word in connection with petrography. And your suspicion is quite defensible, because a trivial typographical error like that would be well within the capability of any compositor. But no, it is not a misprint. I selected that title because the printer had a job-lot of type that he wanted to use.

Then, too, what a splendid reference horizon it makes from which to measure the stratification of this evening's entertainment up and down. What a sense of security the preceding speakers must have felt when they saw this solid substratum under them, even if it is only barren measures. You will notice, too, that it has both of the elements of a good reference horizon, in that it is easily recognizable and is continuous for a great distance.

But to come to the point. Have you ever considered how frequently we employ the terms of the geologist to describe members of the human race, but how seldom the operation is reversed? We say, for example, that when the object of a young man's affection gets the marble heart and gives him a stony stare, it is apt to make him feel pretty rocky. But, if he is sensible, he will soon get over it and, finding a new object for his attentions, will begin to write sonnets on her sapphire eyes, sparkling like diamonds; on her pearly teeth and her silvery laugh; on her coal-black, or it may be, her golden tresses, according to the prevailing fashion. We say that John Smith has a sandy complexion and is a regular old skin-flint. When the Chicago pitcher sends the New York batter to first base on four balls, we quite properly shout 'glass arm' at him. And finally, when you were a barefoot boy in the country, didn't you think that your grandmother was a gneiss old lady because she appreciated your appetite? And so it goes; you see how incessantly we have to go to the mineral kingdom for similes and metaphors.

Now I propose to reconstruct the science of petrography on an anthropomorphic basis. How much more pleasant it will be to think of the rocks as having personalities, characteristics of soul and spirit as well as of body. When we pine for amusement, instead of going down-town to a poor show, we will come up here and become brothers of the no longer insensible rocks.

To go about this we only need to take the adjectives now employed in describing the minerals and translate them into terms applicable to the description of a human being.

To begin with the colors, we suspect a man whose face is always red of being bibulous; a green man is either unsophisticated or an Irishman; when a man is blue, he is melancholy; and, of course, yellow and brown are respectively blonde and brunette. Applying the same method to the shapes of minerals, a square man is an honest man; a round man is corpulent; rectangular means blockheaded; and prismatic means slab-sided; we would call a lath-shaped man spindle-shanked, while a man may be short in any one of three ways: He may be short in his accounts —a defaulter, or a man of small stature, like Bildad the Shuhite—a sawed-off, or he may be short like St. Peter, when he said, "Silver and gold have I none," meaning impecunious. Just to translate a few more of the terms of mineralogy into those of anthropology, a soft man is a mollycoddle; an elastic one is a rubber-neck; a flexible one is double-jointed. Dense means thick-headed; coarse means vulgar; while delicate means ladylike. We speak of a porous man as being a sponge, or a grafter, and if you meet a smooth man, you ought to watch him, because he may be a swindler, especially if he has a magnetic attractive personality. A hard man, that is, one hard to get along with, is generally cranky, and a brittle man, one who goes broke easily, is a spendthrift.

Now let me illustrate how the new terminology works. Suppose we describe Mr. Fluorite. He is an honest but blockheaded mollycoddle, generally broke and given to fits of melancholy. Mr. Quartz is a slab-sided old fellow with a pale complexion; he is cranky and thinks he is sharp, but you can generally see through him. Sometimes our new nomenclature affords pleasing results, as when we describe Miss Augite as a slender, honest, ladylike brunette; at other times, not so much so, as when we describe Mr. Biotite as a rubber-necked double-jointed Ethiopian, such as you have all seen with his head poking through a hole in a curtain while paying a visit to Coney Island.

Now when I first proposed this system to Professor Kemp, he was wild with enthusiasm; he hurled his now obsolete 'Handbook of Rocks' into the waste-basket; he sat down and began to write furiously on the new edition. By his courtesy I am permitted to read to you a couple of paragraphs from this forthcoming book, entitled 'My Brothers the Rocks and How to Recognize Them Without the Use of the Opera Glass'.

Granite.—Granite is a group of four persons. Besides Mr. Quartz, whom I have just described, they are: Mr. Feldspar, who is a portly gentleman, convivial in his habits, and with a milder disposition than Mr. Quartz; Mr. Muscovite, a Russian nobleman who, though he lacks the ruddy glow of outdoor exercise, is a man of marked flexibility and agility; and lastly, Mrs. Pyroxene, a tall slender lady with a striking brunette complexion.

Diabase.—Diabase is a crowded assembly of spindle-shanked white men and fat darkies. Diabase may be likened to a Fifth avenue stage in which all the seats and most of the standing room are occupied by John D. Rockefeller, Joe Cannon, Tom Platt, and others of their build; when the stage stopped at the next corner and Taft and Santa Claus tried to get on, they had to squeeze in as best they could.

Gentlemen, I recommend you to get a copy of this book as soon as it appears.

*A speech delivered before the Journal Club, Columbia School of Mines. Published by courtesy of the President of the Club.

COMPANY REPORTS.

PODEROSA MINING COMPANY.

The report of this copper mining company, operating in the department of Collahuasi, Chile, covers the period of six months ending June 30, 1908. Shipments of ore from the mine to the port of Mejillones amounted to 12,156 tons, averaging 29.9% copper, as compared with 5896 tons of 22.7% copper for the previous six months. The development work accomplished was 670 metres, or sufficient to maintain the ore reserves at 100,000 tons, which the general manager, Robert Hawxhurst, reports as containing an average of 25% copper. The balance-sheet shows the satisfactory profit of £84,923, from which dividends of 25% on the capital were paid, amounting to £60,000; while £15,000 was credited to the reserve fund, leaving £9923 to be carried forward.

NORTH BUTTE.

The fourth annual report of this company, which owns mines at Butte, Montana, covers the year ending December 31, 1908. Owing to the fact that the Washoe smelting plant was closed down till March 1, active operations were confined to 10 months. In that time 422,878 wet tons were mined and 413,582 dry tons smelted. The first-class ore amounted to 35.4, and the second to 64.6%. The recovery yielded 36,929,028 lb. fine copper, 1,283,761 oz. silver, and 1593 gold. The average content of the ore in copper was 89.3 lb. per ton treated. The average prices received were, copper 13.3c., silver 51.7c., and gold $20. Three dividends, aggregating $1,200,000, were paid; $19,696 was charged to construction account; and the cash on hand increased from $174,773 to $582,466. No estimate of ore reserves is given, though A. C. Carson, general manager, says: "The two new levels that are being opened up should give a large reserve of good ore, and thus insure the present rate of production for several years to come."

GREENE CANANEA.

This is a holding company organized by T. F. Cole and associates to acquire the stock of the Greene Consolidated Copper Co. and of the Cananea Central Copper Co., having mines in Sonora, Mexico. The Greene Cananea is capitalized at $60,000,000, of which 2,500,000 shares, having a par value of $20 each, were set aside to be exchanged for the stock of the subsidiary companies, on a basis of 1½ shares for each share of the Greene Consolidated and 1⅜ for each share of the Cananea Central. Up to March 16 last, 934,774 of a total issue of 1,000,000 shares of the Greene Consolidated had been acquired, and 552,868 of the 600,000 shares of the Cananea Central. No dividends were paid during the year, and the expenses of the parent company were met by means of a loan of $25,000 made to it by the Cananea Central.

ROUND MOUNTAIN.

The properties of the Round Mountain Mining Co. are in Nye county, Nevada. They include principally quartz claims discovered in the course of hydraulic operations carried on by the Round Mountain Hydraulic Mining Co. The Round Mountain Mining Co. is at the same time one-fifth owner of the Hydraulic company, which is now in the hands of a receiver. The work on the quartz claims was pushed in 1908, a total of 6775 ft. of development having been done. The available ore reserves include 39,902 tons, which, calculated on the basis of average mint returns for the last two years, $12.30 per ton, are valued at $490,794. On this basis the reserves have been increased during the year $88,294. The net profits to April 1 have amounted to $271,997, of which $127,901 has been distributed as dividends on the capital stock of $1,000,000. During the year 29,582 tons were milled, at a cost of $6.07 per ton and with a total profit of $169,889.

NIPISSING MINES.

The Nipissing Mines Co., incorporated under the laws of Maine with 1,200,000 shares having a par value of $5 each, owns the capital stock of the Nipissing Mining Co., Ltd., which in turn owns 846 acres near Cobalt, Ontario, including the famous Nipissing silver mine. According to the Fourth Annual Report, the Mines Co. in 1908 paid $840,000 dividends, with an administrative expense of $23,323. The Mining Co. paid the Mines Co. $860,000 in dividends. This was derived from shipments of 3504 tons of ore having a net value of $1,363,783. Of this ore 78% was high-grade; 15.8 low-grade silicious, 1.4 low-grade cobalt, and 4.8% nuggets. The average assays were: high-grade ore, 3155 oz. silver, 10% cobalt, 5.48 nickel, 37.69 arsenic; low-grade silicious ore, 209.9 oz. silver; low-grade cobalt ore, 97.8 oz. silver, 10:59% cobalt; nuggets, 18,380 oz. silver. The average price received for the silver was 51.97c. per oz. The cost of producing silver is given as $0.207 per oz. With regard to ore reserves, R. B. Watson, general manager, says: "The estimation of ore reserves in these rich narrow veins will always be unsatisfactory, due to the wide variation both in value and in width, which sometimes takes place in a short distance. It is not economical to completely block out the ore, and heretofore stoping operations have closely followed development, so that the mine has never shown development commensurate with its annual production." In the estimate submitted a total of $1,078,392 is listed by veins.

CINDERELLA DEEP.

The properties of the Cinderella Deep, Ltd., are in the East Rand district, Transvaal, and include the deep horizons of the reefs worked in a portion of the East Rand Proprietary Mines. The capital stock consists of 100,000 shares of a par value of £1. Crushing began in September 1908. Up to December 31 the mill had treated 33,329 tons, yielding a gold recovery of £1 7s. 2.65d. per ton. The expense amounted to £1 2s. 6.42d. per ton, leaving a net profit of £7808 3s. 7d. Milling operations for the first month showed an apparent loss of £2593 13s. 3d., due to the fact that a considerable amount of gold was absorbed by the plates and extractor boxes. The average duty of the stamps for the three months was nearly 8 tons. The ore reserves are estimated at 374,438 tons, having an average assay value of 7.48 dwt. Considerable enlargement of the plant is planned.

KNIGHT CENTRAL.

The Knight Central, Ltd., having acquired 450 claims of the South Knights, Ltd., now owns 895 claims on the Driefontein farm on the Rand, South Africa. In 1908 the capital stock was increased from £525,000 to £900,000, in order to provide for the purchase of the South Knights property. According to S. C. Thomson, consulting engineer, the ore reserves were increased from 282,100 tons having an average value of 7.75 dwt., to 395,400 tons valued at 7.7 dwt. In the west section of the property 1272 ft. of development, exclusive of shaft-sinking, was accomplished. In the east section the incline was sunk 729 ft., to the 13th level, and in addition 11,195 ft. of development and prospecting was done. In the early part of the year the work was disappointing, the ore found being of low grade. Later work, particularly in the South Reef, was more encouraging. A plant of 100 stamps and 3 tube-mills was erected and milling began on January 27, 1909. The addition of 20 stamps is planned.

WITWATERSRAND DEEP, LTD.

This company owns 425 claims and certain water-rights on the Driefontein and Klippoortje claims. It is under the management of Henry Hay, with S. C. Thomson consulting engineer. In 1908 the profit was £357,016 and the tons milled 442,420, as compared with £289,463 and 386,110 in 1907. The average profit was advanced to 16s. 1.67d., as against 14s. 11.93d., dividends of 55% being paid. This was possible, despite the lower grade of ore handled, through decrease in costs. These for December were 15s. 0.44d. The ore-reserves are stated to amount to 1,618,715 tons, having been increased to that from 601,915 in 1903. The present reserves are estimated at 7.79 dwt. per ton. In the stopes 17.35% of the ore was broken by machines at a cost of 5s. 7.15d., as compared with 6s. 4.86d. for hand-work. In all 177,018 oz. were recovered, 59:53% from the stamp-mill and 34.47 by cyanidation. The stamp duty for the year was 5.25 tons. The cyanide extraction was 86.17 per cent.

Mine Signals in California.

In answer to a request from correspondents we re-print the California statute relating to mine signals. The only effect of the statute is to lay violators open to action for civil damages, in which the case would be determined by preponderance of evidence only.

Act 2225.—An act to establish a uniform system of mine bell signals, to be used in all mines operated in the State of California, and for the protection of miners. [Approved March 8, 1893. Stats. 1893, p. 82.]

Section 1. Every person, company, corporation, or individual operating any mine within the State of California—gold, silver, copper, lead, coal, or any other metal or substance where it is necessary to use signals by means of bell or otherwise for shafts, inclines, drifts, cross-cuts, tunnels, and underground workings—shall, after the passage of this bill, adopt, use, and put in force the following system or code of mine-bell signals, as follows:

1 bell, to hoist. (See rule 2.)

1 bell, to stop if in motion.

2 bells to lower. (See rule 2.)

3 bells, man to be hoisted; run slow. (See rule 2.)

4 bells, start pump, if not running, or stop pump if running.

1 — 3 bells, start or stop air compressor.

5 bells, send down tools. (See rule 4.)

6 bells, send down timbers. (See rule 4.)

7 bells, accident; move bucket or cage by verbal orders only.

1 — 4 bells, foreman wanted.

2 — 1 — 1 bells, done hoisting until called.

2 — 1 — 2 bells, done hoisting for the day.

2 — 2 — 2 bells, change buckets from ore to water, or vice versa.

3 — 2 — 1 bells, ready to shoot in the shaft. (See rule 3.)

Engineer's signal, that he is ready to hoist, is to raise the bucket or cage two feet and lower it again. (See rule 3.)

Levels shall be designated and inserted in notice hereinafter mentioned. (See rule 5.)

Sec. 2. For the purpose of enforcing and properly understanding the above code of signals, the following rules are hereby established.

Rule 1. In giving signals make strokes on bell at regular intervals. The bar (—) must take the same time as for one stroke of the bell, and no more. If timber, tools, the foreman, bucket, or cage, are wanted to stop at any level in the mine, signal by number of strokes on the bell, the number of the level first before giving the signal for timber, tools, etc. Time between signals to be double bars (— —). Examples:

6 — — 5, would mean stop at sixth level with tools.

4 — — 1 — 1 — — 1, would mean stop at fourth level, man on, hoist.

2 — — 1 — 4, would mean stop at second level with foreman.

Rule 2. No person must get off or on the bucket or cage while the same is in motion. When men are to be hoisted, give the signal for men. Men *must* then get on bucket or cage, *then* give the signal to hoist. Bell cord must be in reach of man on the bucket or cage at stations.

Rule 3. After signal "Ready to shoot in shaft," engineer must give his signal when he is ready to hoist. Miners must then give the signal of "men to be hoisted," then "spit fuse," get into the bucket, and give the signal to hoist.

Rule 4. All timbers, tools, etc., "longer than the depth of the bucket," to be hoisted or lowered, must be securely lashed at the upper end to the cable. Miners must know they will ride up or down the shaft without catching on rocks or timbers, and be thrown out.

Rule 5. The foreman will see that one printed sheet of these signals and rules for each level and one for the engine-room are attached to a board not less than twelve inches wide by thirty-six inches long, and securely fasten the board up where signals can be easily read at the places above stated.

Rule 6. The above signals and rules must be obeyed. Any violation will be sufficient grounds for discharging the party or parties so doing. No person, company, corporation, or individuals operating any mine within the State of California shall be responsible for accidents that may happen to men disobeying the above rules and signals. Said notice and rules shall be signed by the person or superintendent having charge of the mine, who shall designate the name of the corporation or the owner of the mine.

Sec. 3. Any person or company failing to carry out any of the provisions of this act shall be responsible for all damages arising to or incurred by any person working in said mine during the time of such failure.

Sec. 4. This act shall take effect immediately.

A Novel Gravel Elevator.

The elevation of gravel in hydraulic mining has always been a serious problem. It has constituted a heavy expense, and the low gold-tenor of the average placer is such as to necessitate severe economy. The hydraulic elevator has been eminently successful when there was an abundance of cheap water available under high pressure. It replaced no other part of the operation; the hydraulic giant was needed for caving the bank and supplying the water to wash the material to the elevator pit, where a new jet of water could drive it up a pipe to a sluice; in short, the only function performed was that of gaining grade for subsequent sluicing in the ordinary way. Mechanical elevators have proved almost universally unsuccessful because of their small capacity and high cost of maintenance. The field for mechanical elevators seems to be limited except for machines of great size, constructed as ponderously as a dredge, and costing an almost equal sum. These disadvantages have led to the invention of a new system, known as the Ruble Gravel Elevator, which, in effect, consists of a combined grizzley and undercurrent, placed at the head of an inclined flume or box, up which the gravel is driven by a stream from an ordinary hydraulic giant. The spent water spreads out with the gravel over an apron leading to a grizzley, beneath which is the undercurrent. The latter is, in fact, a return sluice, fitted with riffles in the same manner as a sluice on a dredge. The apparatus is compactly built, and is mounted on wheels. It can be moved forward and backward near the face of the gravel, the tailing being stacked as it is moved. The gravel may be conveyed to the appliance by mechanical or hydraulic means. The Ruble elevator has been in use in Idaho, Oregon, and other States, with excellent results. It has solved a difficult problem in placer mining. The apparatus is manufactured by Ruble Bros., Golden, Oregon.

Commercial Paragraphs.

The Ernst Wiener Co., New York, has appointed W. K. Kenly Co., First National Bank building, Chicago, as its district sales agents.

The Allis-Chalmers Co. has moved its Los Angeles office from the Citizens' National Bank Bdg. to larger and more convenient quarters at 129 East Fifth street.

The Wood Drill Works of Paterson, N. J., has put in a stock of drills at Toronto, Ontario, Canada, at the show rooms of the A. R. Williams Machinery Co., which has branch offices in Winnepeg, Vancouver, and Montreal.

The Fred M. Prescott Steam Pump Co., Milwaukee, Wis., advises that in order to meet the increasing demand in the Southern and Southeastern States an office has been opened at the Candler Bdg., Atlanta, Ga. R. L. Radcliffe will be in charge.

Dividends.

On Tuesday, May 4, the Bunker Hill & Sullivan Mining & Concentrating Co. will pay dividend No. 140 of $45,000. This makes the amount of dividends paid since January 1 $300,000, and the total to date $10,971,000.

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EDITORIAL.

LATERAL EXPLORATION rather than additional sinking is often the wiser as well as cheaper form of development. The Camp Bird management, acting on the advice of Mr. J. E. Spurr, has been exploring the western end of the property, and Mr. W. J. Cox reports finding ore running over $200 per ton.

SUPPRESSION OF REPORTS is a poor way of inspiring confidence. The stockholders of the Tennessee Copper Company are wondering why they fail to see the report of operations for 1908. It is understood that the report was printed, but has not been distributed. Since the property has been producing, no such secrecy has ever been observed.

EXTRA-TERRITORIAL rights are rapidly disappearing. The last to be surrendered were those of British subjects in central and southern Siam. Northern Siam has for a number of years had a system whereby the British Consul sits on the bench with Siamese officials. Such anomalies, and that of our own Federal court at Shanghai, are incidental to the contact between civilizations of differing ideals. They disappear as peoples come to better understanding.

SEATTLE is working hard to make the Alaska-Yukon-Pacific Exposition, not the largest but the most beautiful world's fair yet held. In this we hope it may succeed. Mere size in expositions is little to be commended, and we are glad to see emphasis in this case put on beauty, which the site on Lake Washington, with its mountainous background, renders particularly easy of realization. The exposition will probably be remembered also as the one ready on time. Remarkable progress has been made in erecting buildings and installing exhibits. There will be much to interest mining men, and even the 'Midway' is to be called the 'Pay Streak'.

PLACER-TESTING seems simple. In principle it is one of the simplest things on earth, but accuracy necessitates attention to details and an understanding of the means for overcoming constantly recurring difficulties, which knowledge cannot be learned through an inspirational process. The gross errors in sampling that have led to so many disastrous failures in dredging have been due to overestimation of the gold-content in the gravel. The public has been persuaded that dredge-mining is the safest on earth, that the net profit from a given area can be absolutely calculated. The gross value certainly can be approximated almost as closely as the gross tonnage from a coal seam, if one knows how. The article on testing dredgeable gravels, by Mr. William H. Radford, printed in this issue, is a notable contribution to the subject. It explains the approved

modern practice, by one who has taken a leading part in developing it. He speaks with the authority of years of experience in which he has been able to compare the results of subsequent dredging with original estimates from sampling in many fields.

COMPARISONS, when carefully made, are extremely useful, and we think many of our readers will be interested in the paper on 'Methods of Copper Mining' appearing in this number. Mr. H. L. Hancock, the author, is general manager for the Wallaroo & Moonta Mining & Smelting Company, Limited, and his observations are based on a visit to the principal copper mines of Europe and America made in the interest of his company.

WHILE the Anaconda copper mine was closed the stock of the Amalgamated Copper Company touched a low level, and during the first two months of 1908 the quotations dropped to 45⅛. The reaction has been steady ever since, until on May 8 the price had mounted to 84¾, a gain of 11 points in a month. This was in spite of the anticipated death of Mr. H. H. Rogers, and of the knowledge that the cost of shutting down had produced a deficit on the year's operation of $1,317,020. This was covered out of the honey in the hive from previous flowery seasons. The surplus on hand at the end of 1908 was $4,944,443, out of which dividends of $2,400,000 were paid. The rally in prices can not be accounted for except as being an evidence of belief that the long-cherished purpose of the group of capitalists controlling the Amalgamated to effect a combination for dominating the copper market was on the point of attainment.

PANAMA has laid many fields under tribute to aid in building the great waterway. We referred in our issue of May 15 to the visit of Mr. Sidney B. Williamson, Chief of the Pacific Division of the Canal. We understand that the object of Mr. Williamson's visit was to study hydraulic mining methods in California, Oregon, and elsewhere, with a view to applying these to the excavation of a section of the Canal between Miraflores and Corozal. It is proposed to develop sufficient pressure-water by pumping from tide-waters on the Rio Grande, and to excavate a total of about 8,000,000 cubic yards, elevating by semi-portable, dredge-type, centrifugal pumps. Part of the material will be used for a dam on the west side of the Miraflores lock-site, and the rest to fill and reclaim the swamp-lands on either side of the actual canal. The advantages of this system will be that work can progress considerably in advance of the time necessary to get the dredges up to that point, and will save the cost, delay, and annoyane of towing the product out to sea. The capital outlay and current expenditure of this method of operation will probably compare favorably with any system of dredging. The records of this work will be of value to future large pump-sluicing projects. The influence will thus react beneficially upon the mining industry, which is contributing this method to the great national work that is to link the coast-lines of the Atlantic and the Pacific.

Rand Milling Practice.

Heavy stamps have forced the tonnage of gold mills in the Transvaal to a point scarcely dreamed of a few years ago. For about ten years, stretching from 1890 to 1900, a sudden outburst of inventive fever in the United States expended its fury in high-weight stamps. The increase from the old standard 750 to the 900-pounder was mainly promoted by cheaper transportation; the change could be made without altering the lines of mortars adapted to the lighter stamps; but when 1200-pound stamps were tried in the old mortars the output suffered, and costs were not reduced. The inventor accordingly sought to evolve special mortars to meet a fancied 'problem'; anvil-blocks were introduced, adding another difficulty to the mill-man's trials in keeping a rigid battery; everything was done except to work out new mortar-patterns on the old model, adapted in details to the larger mass of pulp and to the altered wave-motion. The mill-superintendents in South Africa, with that spirit of conservatism which is so strong in the British people, have been working out this problem according to the true principle of evolution, that of gradual change. The weight of stamps has been progressively advanced as other details have been modified to suit. The result is that 9 tons of ore per stamp per diem is a common duty today on the Rand, obtained with 1600-pound stamps. In stamp-milling we have not kept pace with the South Africans, and in the light of their achievement we may pronounce nine-tenths of the American mills an anachronism. We have advanced the cyanide process faster than the engineers on the Rand, but they are coming down the home-stretch at a rapid pace. They have perceived the need and value of co-operation and exchange of ideas as we have not. Close physical association of a large number of enormous mines has been responsible for that. We will not allow that it came from a broader original view than our own, but they have adopted the policy of association, with a full consciousness of its virtue. The Mines Trials Committee, recently constituted, has been busy elaborating new processes and wrinkles, which are now being applied on a working scale. This permanent commission tests and improves the methods recommended by inventors, who, in the face of this systematic scheme for betterment of an industry, would probably prefer to be called designers. There hangs an odor of the intellectually unkempt in the hair of him who poses as an 'inventor'. We are discovering things by method, not by guess, in these days; the scientific drag-net of Burbank is what the modern world relies on, and that is what the Rand managers rely on. It is the way that is sure to win. We note with interest, in the letter from our Johannesburg correspondent, that the tendency to discard amalgamation is increasing. That has become the order of the day with the silver metallurgists in Mexico. We suspect that Mr. W. A. Caldecott has been responsible, directly or indirectly, for the innovation on the Rand. He had observed the all-slime method south of the Rio Grande that has made ten dollar ore workable even in remote situations in the Sierra Madre. Amalgamation also seems

destined to become enshrined among the interesting relics of metallurgy. The great mines are coming to the simpler method of fine-grinding, agitation with cyanide solution, and filtering. The conditions which render amalgamation preferable are comparatively rare. We understand that Mr. Caldecott will soon present a paper to the Institution of Mining and Metallurgy, dealing with the evolution of recent practice on the Rand. This will probably set new standards which will have world-wide vogue.

Siberian Placers.

In the last decade the world's stock of gold has increased one-half, and in the last quarter of a century it has doubled. Since the discovery of America the production, according to the Bureau of Statistics, has aggregated $13,000,000,000 in value. The world's fund of gold money now amounts to $7,000,000,000, and expanding industry still constantly calls for more of the yellow metal. Producing it is the problem of the mining engineer. To find it, all lands are prospected and re-prospected. Placers, because they give quick returns and yield gold free from the base metals and consequent complications of metallurgy and markets, were first to be attacked, and interest in them is recurrent.

The pan, the rocker, and the sluice have been the common implements of gold mining for generations. Hydraulicking was a later development, and dredging is the most modern. Gold which could be won by simple means was as open to our predecessors as to us. Except as new methods or new machinery serve us better, we can count on scant returns from reworking their ground. The pioneers were no mean miners, within the limits set by their tools, and many a modern engineer has uncovered bedrock only to find it had been swept clean 'in the 70s' or in remoter periods. The early miners had, however, neither our experience nor our machinery. Hampered always by lack of transportation, and usually by high cost of food and supplies, much gold was necessarily left. In Alaska and the Yukon, to take a modern instance.

Among the most inviting fields open to American miners is Siberia. With the cumulative experience due to work in California and Alaska, the cordial relations existing between Russia and the United States, and the liberality of the Siberian mining laws, there is no reason why Americans should not take large part in the development of that country. Good unclaimed placer gravel occurs in Siberia, just as accessible to San Francisco and Seattle as a great deal of that now being prospected and mined in Alaska, or even in the States. Last summer promising placer ground was staked and tested within ten miles of the Okhotsk sea, and many of the short streams running down into that body of water, though not largely prospected, are known to carry gold. Near the mouth of the Amur, Mr. C. W. Purington is re-working old gravels which contain 40 cents per yard and over. Back from this, and stretching to the Ural Mountains, 4000 miles away, is a territory 1000 miles wide—an area larger than the whole of the United States—throughout which placers occur and have been worked.

Siberia is by no means an unknown country, though relatively unpopulated. Mr. Purington and others have given many interesting details regarding it, in the technical press of England and the United States. It is far from being a frozen land, and the difficulties of living and work there are not greater than are constantly overcome in many parts of our own country. Preliminary geological maps have been made and are readily available. The production of numerous streams is recorded, and detailed knowledge of many areas can be had. The most complete report is that of Reutofski, a geologist long in the Government service, who has summarized in a single volume and map much that is of interest. According to him, up to 1904 Siberian placers have yielded at least $700,000,000, and the old mines, if reworked under modern conditions, would yield two or more times as much. If the unexplored territory and the yield of quartz veins be taken into account, an output many times larger may be expected.

The Lena goldfields, as may be seen from the map, would be opened to modern industry by means of a short railway from Lake Baikal to the head-waters of one of the tributary streams. One creek in this district, the Nakatami, yielded, according to Reutofski, between 1865 and 1900, $54,000,000 from gravels having an average tenor of $10 per yard. On the Akakan, one of its tributaries, the pay-streak is reported to be 300 to 500 feet wide, and has been worked for three miles along the stream. The gravel is 3½ to 15 feet thick and carries an overburden of 60 to 280 feet. It is only partly frozen. The stream has old bench gravels as well as modern alluvium. From 1868 to 1900, $26,000,000 was taken from it, some of the gravel being worth as much as $30 per yard. The Dolgardine, also a tributary of the Nakatami, has a pay-streak 70 to 350 feet wide, that has been traced three miles. The gravel is 10 to 40 feet thick and the overburden 40 to 90 feet. From 1885 to 1900 this stream yielded $9,000,000 from gravels running $4 to $13 per cubic yard. From Verni creek $15,000,000 has been won in a length of one and three-quarter miles. On another stream, gravels 7 to 10 feet deep, carrying $12 per yard, have been mined. An English company working in this district obtained an average of over $8.50 per cubic yard, through three seasons' operations. On the Nygri, $22,000,000 has been produced from gravels running $4 per yard. The situation here is exceptional, in that water was available with 350 feet of fall, and hydraulic work was possible. In general, future work must be done largely with dredges.

Northern Siberia is a great plain stretching off to the Arctic Ocean. Reutofski states that it carries many old marine shore lines. The great northward-flowing rivers give access to much of it from the trans-Siberian railway, and short railway lines may be readily built, where necessary. Knowledge and capital are needed. Heavy pumps to drain the gravel, more complete utilization of such water-power as exists, steam-shovels and dredges in the place of hand-work and carts, and steam thawing are all demanded to unlock the stream of treasure. They say 'gold is the Siberian bottom'. In cleaning it there seems to be room for many miners.

Personal.

Professional men are invited to send news of their engagements and travels Such news is interesting to friends.

JOHN B. HASTINGS is at New York.

STUART RAWLINGS is in San Francisco.

W. S. NOYES has returned from Oregon.

THOMAS H. LEGGETT is in San Francisco.

CHESTER A. THOMAS has reached Dawson.

H. KILBURN SCOTT has left for Nova Scotia.

W. A. SCOTT leaves Seattle for Ketchikan, May 21.

JOHN W. FINCH has returned to Denver, from New York.

E. J. FRANZ is in San Francisco, on his return to Plumas county.

THEO. F. VAN WAGENEN has returned to Zacatecas, from London.

HERBERT HAAS has gone to Salt Lake City, Utah, and Cleveland, Ohio.

CHARLES M. BECKER is at the Bonanza mines, in Saguache county, Colorado.

J. PARKE CHANNING has been in San Francisco, on his way to Phoenix, Arizona.

F. M. FIELD, metallurgical engineer for the Tonopah Extension Co., has gone from Ogden to Tonopah.

FRANKLIN R. CARPENTER, of Denver, is at the Boyer-Nevada Copper Co.'s mines, in Churchill county, Nevada.

C. H. WILDMAN, of Placerville, has gone to Canada, to take charge of gold mines in the Algoma district.

S. E. BRETHERTON is in Shasta county, on business connected with the Friday-Lowdon Copper Company.

E. E. HARVEY, general manager for the Porcupine Gold M. Co., is at the property, in Alaska, ready to direct the season's work.

LAWRENCE N. WAGNER has sold his engineering and assaying business, but will continue to make his headquarters at Nevada City.

GILMOUR E. BROWN, of Aqua, Santa Iquique, Chile, is going to Scotland for a holiday trip. He will examine mines near Coquimbo and Santiago on the way.

OSCAR A. KNOX, recently general manager for the Octave Mining Co., Octave, Arizona, has sailed from San Francisco for Sydney, on his way to Western Australia.

THE CLASS in mine surveying of the Mackay Mining School at Reno, Nevada, will go to Grass Valley, June 1, for three weeks work in the Murchie and other mines, followed by three weeks study of mining geology.

THE APPALACHIAN ENGINEERING ASSOCIATION met in Roanoke, Va., on Saturday, May 8. The following papers were read: 'Lead and Zinc Ores in Wythe and Pulaski Counties', by M. M. Caldwell; 'Organization and Engineering Difficulties of the Virginian Railway', by William N. Page; 'The Virgilina Copper District', by Thomas L. Watson; 'Geologic Engineering Code of Ethics', by B. Halberstadt; 'Properties and Uses of Mineral Gypsum', by F. A. Wilder.

THE PASSENGER LIST of the *Corwin*, which sailed from Seattle for Nome, May 10, included reservations for the North American Dredging Co., Gold Beach Dredging Co., Thomas S. Darby, H. Leland, William West, Frank Shara, Earle Hunt, R. J. Healy, Fairhaven Water Co., Thomas Ross, Louis Lane, E. W. Johnson, A. H. Dunham, J. Henry Smith, F. A. Martin, J. F. McCulloch, C. McKay, David Fox, J. E. Johnson, L. B. Jarvis, J. M. Johnson, Gerald Hutton, N. Wilson, A. Adams, A. Boarstad, R. B. Woodson, Charles Elwood, F. N. Wood, M. M. Henry, J. W. Schaffer, J. B. Cawfield, Patrick Heenay, Nick Sinagra, Harry Benson, D. McDonald, A. Johnson, T. Parsons, John Glasgo, J. P. Peterson, John Stratton, Charles Mitchell, John Spritzer, F. H. Sharp, E. C. Benson, R. G. Leslie, M. Lynell, F. J. Engles, Jack Gale, W. Watson, Joe Pongee, L. Vanbebber, W. L. Bunger, E. Siegenthaler, J. C. McGrumpey, P. Siegenthaler, N. J. Bunger, P. D. Lahart, M. Verner, Joseph Miller, C. Schmitz, Patrick McFadden, James Gallagher, Robert Kirby.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, May 20.

Antimony	12—12¾c	Quicksilver (flask)	44—45
Electrolytic Copper	15¼—16½c	Spelter	6¼—7c
Pig Lead	4.55—5.50c	Tin	32—33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 13. £ s. d.		May 20. £ s. d.
Camp Bird	1 1 6	ex div.	1 3 3
El Oro	1 6 9		1 6 3
Esperanza	2 17 0		3 3 0
Dolores	1 10 0		1 10 0
Oroville Dredging	0 11 0		0 12 9
Mexico Mines	5 12 6		5 12 6
Tomboy	1 1 3		1 2 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 14	12.94	4.31	5.06	52⅞
" 15	12.94	4.31	5.09	52⅝
" 16	Sunday.	No market		
" 17	12 94	4.31	5.09	53
" 18	12 94	4.31	5 11	52⅝
" 19	12.94	4.31	5.14	52⅝
" 20	12.94	4.31	5.15	52⅞

MINING QUOTATIONS—NEW YORK.

	Closing Prices. May 13.	May 20.
Amalgamated Copper	82⅞	82
American Smelting & Refining Co	93	92¾
Boston Copper	14¾	14¾
Butte Coalition	25¾	25½
Cumberland-Ely	8¼	8 1/16
Dolores	5	5
El Rayo	2⅝	2
Giroux	8	7⅞
Greene-Cananea	10⅞	10½
Indiana Sonora	3¼	3⅛
La Rose	7⅛	7¼
Miami Copper	15⅝	15⅛
Nevada Consolidated	22⅜	23
Newhouse	2¾	2⅝
Nipissing	10½	10¾
Ohio Copper	6⅞	6⅜
Tennessee Copper	43¾	41⅝
Utah Copper	51¼	51⅛
Yukon	4⅝	4¾

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. May 20.		Closing Prices. May 20.
Adventure	9	Mass	14
Ahmeek	150	Mohawk	65¾
Allouez	39½	North Butte	60
Arcadian	5	Old Dominion	54½
Atlantic	9½	Osceola	134
Calumet & Arizona	103	Parrot	34¼
Calumet & Hecla	640	Santa Fe	2½
Centennial	31½	Shannon	15¾
Copper Range	80¼	Superior & Pittsburg	14½
Daly-West	9	Tamarack	70
First National	5⅝	Trinity	13¾
Franklin	15	United Copper Con	12
Granby	103	Utah Con	41
Greene-Cananea, ctf	10⅝	Victoria	4⅞
Isle Royale	27½	Winona	5¾
La Salle	14⅛	Wolverine	147

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, May 20.

Atlanta	$ 16	Mayflower	$ 13
Belmont	85	Midway	25
Booth	19	Montana Tonopah	75
Columbia Mtn	12	Nevada Hills	1.25
Combination Fraction	83	Ophir (Comstock)	1.22
Daisy	31	Pittsburg Silver Peak	54
Fairview Eagle	20	Rawhide Coalition	25
Florence	3 00	Rawhide Queen	29
Goldfield Con	7.75	Round Mountain	79
Gold Kewenas	15	Sandstorm	10
Great Bend	10	Silver Pick	19
Jim Butler	15	St. Ives	10
Jumbo Extension	14	Tonopah Extension	65
Llanos Con	75	Tonopah of Nevada	7.12
MacNamara	24	West End	31

General Mining News.

ALASKA.

A corres,ondent at Nome writes that this has been a very quiet winter on the Seward Peninsula. No new strikes of importance have been made on the tundra and there will not be as many drift mines at work next summer as there were last, but the large companies owning ditch systems will operate with full crews. The snowfall to date has not equalled that of last year, but there is still a good snow month to count on.

The Ellamar mine, on Prince William sound, is opened by a 600-ft. 3-compartment shaft, and has approximately 5000 ft. of lateral development on a zone of chalcopyrite ore in a slate formation. The ore runs from 3 to 14% copper and 32% iron. The mine has been operated the greater part of the time for 10 years and has been a profitable shipper. During 1908 not much ore was shipped, but operations are in progress now and ore shipments are to be resumed later in the year. The equipment consists of a steam-hoist, air-compressor, and a 600-ft. belt-conveyor for delivering the ore from the bins at the mine to the bunkers at the wharf. F. M. Jordan and J. D. Meenach, of Seattle, are active in the management, with L. L. Middlekamp as superintendent at the mine.——The Dunton mine, near Hollis, on Prince of Wales island, has a contact vein between slate and eruptive rock, having gold-bearing ore that runs $20 per ton. Development has reached 200 ft. depth. The property is managed by M. K. Rodgers, of Seattle, who has shipped in a small stamp-mill for work during the period of further development.

ARIZONA.

COCHISE COUNTY.

Thomas Bardon has issued the annual report of the Shattuck-Arizona Co. for 1908, in which is shown the advance made in development work. No ore has been mined during the period, but improvements have rendered possible a daily output 25% in excess over that of the year previous. There are now nearly four miles of drifts and cross-cuts between the sixth and ninth levels, and 800 tons per day can readily be mined when market conditions become favorable. It has been deemed inadvisable to build a smelter at present for the same reason, but plans for so doing have already been considered. Mining operations have been conducted under the superintendence of Joseph Walker.——At the Lowell shaft of the Copper Queen Mining Co. the drift on the 1200-ft. level has been finished, and now all the ore above that level is being hauled by electric motors to the Sacramento. Electric motors have now superseded mule-haulage in the Holbrook mine, and recently some pairs of 20-hp. motors have been electrically connected to single controllers whereby from 30 to 35 mine-cars can be hauled at a trip. Ore production at present is about 3500 tons per day, nearly all of which comes from the Sacramento shaft. Gerald Sherman is mine superintendent, and J. S. Taylor, James Finley, and Thomas Devine are the mine foremen.——Sulphide ore has been struck in the Black Prince mine, near Johnson, at a depth of 430 ft. The shaft has been sunk 6 ft. in material averaging 20% copper.

GILA COUNTY.

Options upon the Saddle Mountain, London-Arizona, London Range, and Ball Copper company properties, at Christmas, have been secured by Edward B. Kurtz on behalf of the American Finance & Securities Co., of New York. The four groups concerned comprise 3000 acres of land, and are being examined by the American company's engineers, Louis S. Noble and A. H. Jones, of Denver. The Saddle Mountain Co. owns a smelter with a capacity of about 225 tons per day, but a new one will probably be built on a larger scale for use of the combined properties. Kurtz says that the Phoenix & Eastern railroad will be extended eight miles to reach the mines.

YAVAPAI COUNTY.

The Big Stick Gold Mining Co., operating in the Eureka district, has lately received a 35-hp. steam-hoist, two compressors, and some machine drills at the mine, which is 20 miles from Date creek on the Santa Fe, Phoenix & Prescott railway. The company's 20-stamp mill has just been put in operation, under the management of Thomas E. Campbell.

CALIFORNIA.

ELDORADO COUNTY.

The Mount Pleasant mine near Grizzly Flats is soon to be re-opened. This mine has produced about $4,000,000.

INYO COUNTY.

The Standard Consolidated Mining Co. at Bodie has overhauled its mill and made several improvements to the plant. Arrangements are being made to increase the capacity of the cyanide plant to handle the ore being developed in the lower workings.——The first big strike this year in the Bodie district has just been made, and there is quite an excitement in consequence. Quartz specimens of high grade have been brought back by the discoverers, A. Belmont and E. Gray, who say that the location of the new find is 10 or 12 miles south of Bodie. They naturally do not wish to specify any more accurately.——The Casa Diablo mine, 20 miles north of Bishop, is working 40 men. Clarence Beale is superintendent.——The Gold Ledge Mining Co. has installed two 30-ton Huntington mills and 10 cyanide tanks. An 800-ft. aerial tarm will be built to connect the mine and mill.——Lessees at the Silver Bow mine southwest of Bishop have struck ore that will be shipped to the smelter at Keeler.

NEVADA COUNTY.

The mill-run at the Oustomah mine for six days yielded nearly 200 lb. of amalgam, which is about $1400. The ore is being taken out on the 800-ft. level and the vein has every appearance of remaining strong and it is believed that another fine shoot is being developed.——The Union Lumber Co. has the contract to furnish the Black Bear Gold Mining Co. with 40,000 ft. of lumber, to be used in the construction of the 10-stamp mill which the company recently purchased and has on the ground ready for installation. The shaft is now 300 ft. under the croppings and will be sunk 200 ft. farther. J. H. English is superintendent.——The Washington Mining & Milling So. expects to have 20 stamps dropping at the Giant King mine in June.——The new 10-stamp mill at the Golden Gate mine has been started. W. P. Martin is superintendent.——The Ocean Star mine at Ormonde, four miles above Washington, has been bonded by M. D. Cooley to E. C. Reed and F. U. Hubbell, of San Francisco, the latter having made their first payment on the property.

SAN BERNARDINO COUNTY.

(Special Correspondence).—A 5-ft. vein of gold-bearing ore, running from $25 to $60 per ton, has been cut in the shaft on the Black Warrior claim of the Gold Park Consolidated mines. It is expected to start shipping soon. The company controls 52 claims, which are being examined by an English syndicate with a view to its purchase. The consideration is said to be $300,000. The property is thoroughly equipped with machinery and 30 men are employed.——The Stanford Mining & Reduction Co. is steadily operating the Gold Coin and Stanford mines, near Johannesburg, with good results. The shaft at the Gold Coin is down 350 ft., with about 3000 ft. of development. The Stanford shaft is 300 ft. deep. The vein is composed of silicious ore, over 2 ft. wide, and is worth from $20 to $60 per ton. Equipment consists of a 15-hp. hoist, 10-stamp mill, and a 30-ton cyanide plant.——The Atalia Mining Co. is maintaining steady shipments of tungsten ore to Germany by way of San Francisco. About four carloads per month of high-grade ore is sent out. Twenty men are employed. San Francisco people are interested.——John L. Winney and Fred Ferris have closed a deal for the Ward mine at Seventeen Mile post. The consideration was $18,000. Extensive developments are intended.——A 3-ft. vein of $18 ore has been cut at a depth of 30 ft. on the Great Northern claim of the Twenty-Nine Palms Consolidated property. Driving and cross-cutting is under way.——A new district, 10 miles from Soda Lake station, on the Tonopah & Tidewater railway, is attracting attention. The outcrops show copper, gold, and silver minerals.

San Bernardino, May 15.

SAN LUIS OBISPO COUNTY.

E. E. Henderson, superintendent for the Palmer Oil Co., has purchased 340 acres of oil land for that company. The land includes the Blakeman tract, 100 acres, and 240 acres of the Wickenden ranch.

SHASTA COUNTY.

Frederick Lyon, former manager for the Mammoth Copper Co., has succeeded as managing director for that company, following the term of A. F. Holden, who, while relinquishing his directorship of that company, will remain as a heavy stockholder.——The tramway from the Balaklala mine to the smelter at Coram has been repaired and started again.——The Mountain Copper Co. has discontinued the roasting of ores at Keswick. Two Wright roasters have been calcining sulphide ores in preparation for shipment to Martinez.

SIERRA COUNTY.

Some rich ore has recently been found in the Rainbow mine near Alleghany, which L. P. Woodbury has under bond. ——The Bonanza King has some high-grade ore that it expects to ship to Selby's. E. H. Wilson is the owner.——An electric-lighting plant, two-drill compressor, and two machine-drills are to be added to the equipment of the Snowden Hill mine above Camptonville.——The old Brush Creek quartz mine near the Mountain House, which is owned by the Brush Creek & Ante-Up Mining Co., is to be re-opened. L. A. Armstrong, who has been here for several months, will be in charge of the property.

TRINITY COUNTY.

The vein is exposed in four levels of the Phillips & Hensley mine. Some specimen rock is being taken from the lowest level.——Work for the season has commenced on the famous Rattlesnake mine in Trinity. This property is owned largely by Santa Cruz people, including Jacob Liebbrand and Ed. Armstrong.——The 5-stamp mill at the Grizzly mine is to be remodelled.——A 2-ft. vein of good ore shows in the face of the drift at the Yellow Jacket.——A slide in the ditch of the Union Hill mine occurred Saturday, taking out eight boxes of the flume.——The La Grange has just placed a crew of 15 men at work repairing the flume on the ditch-line on the west side of Stuart's Fork.

COLORADO.

CLEAR CREEK COUNTY.

J. H. Robeson, of Denver, has been appointed general manager for the Dives-Pelican and Seven-Thirty Mining & Milling Co. A working fund of $100,000 is to be provided and during the next month additional men will be employed. Robeson was the manager of this property for several years previous to 1904, during which time over $2,000,000 was produced.——The Burleigh Mining & Milling Co., holding the Pelican mill under lease, is now running two 12-hour shifts, and producing from 30 to 40 tons of concentrate per week. The new installation of machinery is effecting a saving of 85%. Two aerial tramways are in operation, the capacity of each being 125 tons daily. It is estimated that there is enough material available to insure the continuous operation of the plant for three years. W. A. Hood is manager.——A rich strike was made this week at the Marshall-Russell adit, the portal of which is situated at Empire Station, four miles below Georgetown. At a distance of 3000 ft. from the portal the Neef vein was intersected, an 8-in. streak of smelting ore being encountered carrying between $65 and $70 per ton in silver and lead. The percentage of zinc is so small that no penalty will be imposed by the smelters.——J. L. Young, the manager of the Golden Glory adit on Saxon mountain, has enlarged his development operations, and has lately cut a 2-ft. vein of $28 ore carrying gold and silver. He now has 25 tons of first-class ore ready for shipment that is worth $85 per ton. The same company is operating the Drummond group of mines, where machine-drills are to be installed, run by electricity.——The richest strike ever made in the history of mining in West Argentine is reported from the King and Queen property, situated on McClellan mountain, where the owners, Davis & Maxwell, have found a 6-in. streak of ore that assays 1227 oz. silver per ton. The ground has been opened for 15 ft., with the ore-shoot still in evidence.——The output from the Josephine mine on Kelso mountain has been more than doubled during the last two weeks, and as soon as the roads are in condition, the ore will be brought to the purchasers in Georgetown. The manager, John Sapp, has started a new adit at a lower level than the other, and will soon install a water-driven compressor, as his company owns valuable water-rights on West Clear creek.

The fiftieth anniversary of the discovery of gold in the Rocky Mountains by George A. Jackson in 1859 has been celebrated at Idaho Springs. The location where the discovery was made has been purchased by Lafayette Hanchett, of Salt Lake City, and presented to Idaho Springs as a park. A monument has been erected on the spot where the first nugget was found.

GILPIN COUNTY.

The Newhouse tunnel was driven 303 ft. in March and is advancing 10 ft. per day. It has cut veins in both Illinois and Gardner mines.——George T. Mosch, of Tolland, has taken a contract to extend the Gold Run cross-cut adit near the head of South Boulder creek, in which Hirsch & Co. of New York are interested. The main level is in a distance of 420 ft.——Jose & Co., leasing in the 400-ft. level of the Specie



Counties of Colorado.

Payment mine on Bellevue mountain shipped a lot of smelting ore to the Chamberlain sampling works.——The Eureka mine of the Gilpin-Eureka Mining Co. is shipping heavily to local stamp-mills.——The Senator and Senator Extension mines, situated east of Black Hawk, were recently purchased from the Black Hawk owners by the Senator Mines Co., and operations have been revived under the superintendency of Matt Ryan.

LAKE COUNTY.

The Ball Mountain adit at the head of California gulch has been connected with the old workings of the Sunday mine through a raise driven from the breast of the bore. The raise was driven almost perpendicularly from the adit level, and is 220 ft. high. It connects with an old drift in the Sunday some distance from the main shaft, but serves the purpose for which it was driven, that of drainage and ventilation.——Six furnaces are now running at the Arkansas Valley smelter. This is an increase over the number that were in operation there during the winter.

SAN JUAN COUNTY.

The Silverton smelter has been sold by the Ross Mining Co. to W. B. Lowe, of New York. The consideration named is $60,000, of which $6000 has been paid down. The Silverton smelter was erected in 1900 by the Kendrick-Gelder company and was operated by them on their own and custom ores until it passed into the hands of the Ross company in 1906. They operated it for two summers, and since that

time it has been idle. It is said that W. B. Lowe is also purchasing the property of the Arpad Mining Co., consisting of 23 claims on King Solomon mountain.——Benjamin Ross, of Silverton, has been in Denver purchasing machinery for a cyanide plant to be built on the Esmeralda property in Minnie gulch. From this property much good ore has in the past been shipped to the Durango smelter, and the remaining low-grade material is now to be treated by the cyanide process. Gold is the predominating metallic content.

TELLER COUNTY.

The Consolidated Tramway Co., of Roanoke, Virginia, has commenced the construction of the aerial tram, to extend from the Midget mine, on Gold hill, to the Gold Issue mill, on the northeastern slope of Carbonate hill. The distance to be traversed is about 10,800 ft., and will be built according to the Loop Section system, by which each section operates independent of the others.——The El Paso Consolidated Gold Mining Co.'s estate that last year produced $243,000 under the leasing system has, with the exception of certain blocks reserved for operation on company account, been thrown open to lessees, and already 31 sets of lessees, employing about 150 miners, are at work. The royalties are graduated from 15% on low-grade milling ore to as high as 50% on the high grade. Output in April amounted to 2000 tons of an average value of $27, and it is confidently expected that by the end of May production will be increased by adding to the number of lessees at work.——A new hoist has been installed at the main shaft of the Golden Cycle mine on Bull hill. When in working order the production will be materially increased, and should easily produce 400 tons per day if necessary.

IDAHO.

BLAINE COUNTY.

During the past three months the Nay Aug mines near Hailey have yielded between four and five 50-ton carloads per month, worth about $20,000. This is enough to pay expenses. But now John Thomas, the superintendent, is going to increase the force of men at work, and will also let out several contracts for opening the 900-ft. level. Thomas is now employing 25 men.——D. S. McGonigal, of Custer, South Dakota, has secured an option on the South Fork mine, locally known as the Espey mine. It belongs to Alfred Adams, who bought it in 1907 and developed it by an adit which cut a rich vein when 400 ft. long. There is a 5-stamp mill on the property. The river near by furnishes enough power for all purposes.

BONNER COUNTY.

The Dixie Queen Copper Mining Co., of Sandpoint, has taken over the group of five claims in the Lakeview mining district and will develop the property. The company is capitalized for $500,000, and will have William C. Ames, Charles Edwards, and Ignatz Weil for directors, with Andrew Christenson as manager.——James Ferguson, president of the Princess Panama Mining Co., on Blacktail mountain, announces that operations will shortly be resumed, as an engine, generator, electric motor, hoist, and pump have been installed. The company will add several machine-drills and electric lights. The mine is being worked by lessees who pay the cost of development and a 20% royalty on ore sent to the smelters.

SHOSHONE COUNTY.

F. W. Bradley, president of the Bunker Hill & Sullivan Mining & Concentrating Co., has stated that the mine is in better shape now than it has been at any time in the 20 years he has known it. Development work has brought more ore in sight than has ever been had before, and there is enough blocked out to maintain the present output of 20,000 tons per month for the next ten years. Much of the ore blocked out is low-grade, but the new 500-ton mill which will soon be finished will increase the mill capacity by nearly 50%. There are 500 men employed at the mine.

Fourteen feet of galena ore has been encountered on the 600-ft. level of the Corrigan property, three miles west of Wardner, owned by the Page Mining Co.——The H. E. M. Mining Co. is sacking ore from the upper workings where a rich strike was recently made.——The Snowstorm Mining Co. paid $45,000 dividends on May 2 at the rate of 3c. per share. This is the third dividend this year.

MICHIGAN.

Sinking has temporarily been stopped at the Ojibway mine, both shafts being bottomed just below the 800-ft. level. The cross-cut on that level is being advanced to reach the Kearsarge lode, which is only about 70 ft. distant.——The Michigan is opening exceedingly rich copper ground in the so-called North amygdaloid. The lode has been drifted upon for a distance of 183 ft., showing an average width of 12 ft., of which fully 8 ft. is evenly shot with copper. It is said to be as rich as the portion of the Kearsarge lode opened in the Ahmeek mine, from which 24 lb. of refined copper per ton of rock is being made. There are about 360 men at work in the mine under the superintendence of Samuel Brady.——The Winona Copper Co. is working actively in the No. 4 shaft, and has blocked out 1,500,000 tons ready for stoping. The plans for the new stamp-mill have been drawn and a site made ready for it midway between the Winona and King Philip mines. Construction is expected to begin within the next few months.——Captain Benjamin Chynoweth has just died at Laurium in his 78th year. He was one of the earliest pioneers in the copper country, coming from Pennsylvania in 1856, and for many years was actively connected with the National and Mass mining companies.

MISSOURI.

JASPER COUNTY.

To the west of Joplin there are several mills being erected in the disseminated blanket formation belt. The Briggle mill on the Luke and Ashland is practically completed. It is a 250-ton plant, and will treat the ore from two well-developed shafts. In the same vicinity the Big Fly mill has been brought from the Alba camp and re-erected on the Black Cat lease. The Kittie Mack is being thoroughly developed by an Ohio company and will later have a mill. There are two shafts sunk in a good disseminated ore deposit at 175 ft. that were previously discovered by drill-holes.——The eastern end of the county is seeing unusual activity, and some excellent strikes have been made. A drill-hole on the John Denney farm near Knights has run into ore at a depth of 225 ft., and continued in it for 40 ft. On the George Shelton farm, to the northeast of Carthage, drill-holes have exposed a 10-ft. blanket deposit; and a still larger one has been exposed on the Boyd and Carnahan land at Sarcoxie.

MONTANA.

FLATHEAD COUNTY.

Peterson, Kraus & Turnvall have organized the Grey Eagle Mining Co. of Newport, Washington, with a capital stock of $1,500,000. They own a group of claims in the Troy mining district on which considerable assessment work has been done during the last 12 months. These are copper-gold properties and will be worked extensively during the coming season.

MISSOULA COUNTY.

Announcement is made that the old Iron Mountain mine, near Superior, in the eastern part of the Coeur d'Alene, will resume operations, and it is figured that within the next six weeks not less than 150 men will be employed. Patrick McElmeel, of Mullan, is superintendent and is installing two boilers and a 15-drill compressor plant.——Galena and carbonate ore is being encountered in the face of the drift being run on the Cuba Mining Co.'s property in the Nine Mile district. The drift is in 630 ft., and has a depth at the face of 350 ft. A good showing of galena ore was made in the upper workings at a depth of 160 feet.

NEVADA.

ESMERALDA COUNTY.

Wallace Macgregor has been appointed manager for the Nevada-Goldfield Reduction Co., and will have entire charge of the operations of that corporation.——The water supply of Goldfield now reaches a total of 350,000 gal. each day, which is ample for all needs. The new pumping plant is

situated in the vicinity of Lida, near some new springs which the water company recently developed. The supply has been increased between 60 and 70 per cent.

NYE COUNTY.

(Special Correspondence).—The shaft at the Montgomery Shoshone is down 700 ft., but most of the work is going on at the 'glory hole', near the 200-ft. level. This hole is approximately 200 by 300 ft. in dimensions on the surface, and the ore is gathered on the 200-ft. level through chutes. The orebody runs about $12 per ton. A Chilean mill and other machinery will be added to the mill within a few days. It is estimated that $1,000,000 in ore is blocked out. John Kirchen is superintendent.——Denver lessees on Tramp Consolidated have opened up a vein varying from 12 to 24 in. wide. Assays show from $30 to $100 per ton. About four tons of $200 ore will soon be shipped. The abandonment of work on company account was recently ordered from headquarters at Philadelphia.——The old shaft on the Goldsworthy lease on the Starlight has exposed the Mayflower vein. About 6 ft. of the ore runs $12 per ton.——The Denver owners have resumed work on the Nevada-Bellehelen group. It is understood that arrangements have been completed for the installation of a mill and pipe-line. At the time work was suspended sufficient ore was developed to warrant the erection of a reduction plant.——A 7-ft. vein of good-grade ore has been intersected on the 150-ft. level of the Round Mountain Sphinx property. M. J. Kiely is superintendent.

Rhyolite, May 15.

It is reported in Rhyolite that a deal is on foot to utilize the mill of the Homestake King mine for the treatment of the low-grade ores from the Pioneer lease.——The Gold Hills Mining Co., in which the controlling interest was sold a few days ago by W. J. and Richard F. Tobin to Wingfield and Brown, has brought suit against the Pioneer Leasing & Mining Co., and against the Bullfrog Pioneer Co., for $250,000, alleging this to be the value of ore taken from within the lateral lines of the Gold Hills company's property. The suit is said to be of a friendly nature, to speedily settle the question of apex rights.

STOREY COUNTY.

The litigation between conflicting stockholders in the Comstock-Golden Gate Mining Co., operating on the Comstock lode, Virginia City, which has been pending several months, has been terminated, an amicable settlement having been made whereby the controlling interest has passed from San Francisco stockholders to stockholders in Oregon and Washington. M. J. Carrigan and C. Justin Kennedy represent the latter interests and it is announced that operations at the mine will be resumed at once.

The weekly reports from the Comstock mines show that most of the repair work has been accomplished in the Sutro tunnel; timbers have been renewed, and both water and air-pipes replaced where defective. From the 2100-ft. level of the Ophir mine 23 cars of $22 ore have been extracted from the sill-floor. From the 2200-ft. level 56 others cars were obtained of about the same grade material. But the greater part has been taken from the 2300-ft. level, where the average ore assays $37 per ton. The Ophir shipped 270 tons of second-class ore to the Kinkead mill, and a carload of concentrate to Selby's smelting works. The Consolidated Virginia, Mexican, Union, Sierra Nevada, and Andes mines have all been turning out small quantities of ore, but at the Gould & Curry, Savage, Chollar, Potosi, and Hale & Norcross mines no work has been done.



General View of Virginia City, Nevada.

OREGON.

BAKER COUNTY.

Work at the Morning mine, near Greenhorn, is progressing well, and 30 tons per day are being produced by a force of 14 men. The Psyche mill has been purchased and will be moved to the Morning mine when the snow goes and the roads are in condition for teaming. The plant is a 20-stamp mill, and is one of the best equipped mills in the district. ——The Eureka-Dei Gratia mines are situated 15 miles from the terminus of the Sumpter Valley railroad, and just east of the county boundary. They are owned by Ira Lemons and John Millard, who have driven two adits on the vein, one 300 ft. and the other 115 ft. long. The ore-shoot has been proved for a distance of 200 ft. by numerous open-cuts and short shafts, showing a vein from 4 to 8 ft. wide, averaging $55 per ton. The property is approached by a good wagon-road, and a water-right that controls 500 miners' inches at the lowest stage.——Theodore L. Lammers, president of the National Mining & Leasing Co., who leased the Cougar property near Baker City for 15 months and bonded it for $250,000, announces that active work will begin in a short time.

UTAH.

BEAVER COUNTY.

A. D. Moffat, manager for the Majestic Mines Co., has reported to the main office that he is now in 60 ft. in the south drift and 57 ft. in the north drift on the 500-ft. level of the Harrington-Hickory property. He states that the ore now being taken out assays 62.3 oz. silver and 35.2% lead. The main shaft will be sunk an additional 200 feet.

WASHINGTON.

FERRY COUNTY.

One of the results of the leasing system in Republic camp is that less ore is broken in the mines, but the average values are higher than those of ore broken under the companies' direct management. About 130 men are now employed in the camp, whereas only one-tenth of that number was working a year ago.——The lessees of the south end of the Surprise claim, owned by the Pearl Consolidated Mining Co., have carefully guarded against publicity of what ore they were shipping. It is now known that they are shipping five carloads of ore per week, or about 150 tons of the average value of $33.66 per ton. The pay-shoot has widened from 18 in. to 7 ft. and averages about 5 ft. in width. About 15 men are now working on the lease, which expires about August 1, by which time it is expected the

company will have received sufficient from royalties to pay all past and present expenses.——The new machinery for the San Poil mine has arrived and is being set up. A pole-line from the New Republic Co.'s power-plant is being constructed to supply the electric energy.

KITITAS COUNTY.

The Washington Quicksilver Mining Co. has been organized at Ellensburg with these officers: president, G. W. Tussinger; vice-president, W. G. Eckler; treasurer, H. Stebbins; secretary, Alonzo Rouche, all of Tacoma, where head offices will be established. It is purposed to begin active work at once. The property is 30 miles from Cle Elum, in the mountains, and has produced cinnabar giving a rich yield of mercury.

OKANOGAN COUNTY.

The Double-Header Mining Co. claims to have two systems of veins in a granitic formation, and that they intersect each other. The veins are nearly vertical, having a quartz and calcite gangue carrying silver and gold. In certain of the veins, however, the gangue is quartz unaccompanied by calcite. The development amounts to about 400 ft. of work. Assays of samples show from 20 to 400 oz. silver per ton, and a little gold. It is announced that a mill is to be erected to treat the ore, to consist of a crusher, Huntington or Chilean mills, a tube-mill and cyaniding equipment, to have 75 tons daily capacity. The plans contemplate a hydro-electric plant for power purposes. The property is at Nespelem, 35 miles from Elmira, on the Washington Central railroad.

STEVENS COUNTY.

Conrad Wolfle, manager for the United Copper Mining Co., operating near Chewelah, announces that orders have been placed in Spokane for a hoist, 10-drill compressor, cage, and 6 mine cars, to be installed within the next 60 days.

CANADA.

BRITISH COLUMBIA.

A good showing is being made by the Yankee Girl mine in the Nelson district. It is a property that only a few months ago was considered an ordinary prospect, but at the present time has nearly a million dollars of 'probable' ore. A force of 25 men is at work in the mine, and the adit has been advanced 1500 ft. There are 10 carloads of ore valued at $20 to $60 per ton on the dump awaiting shipment to the railroad.——A strike of 25 ft. of copper ore is reported from the Ikeda mine, on Moresby island. This mine is owned by Japanese capitalists, who were among the first to operate on the island. The mine is proving up well and is exceeding expectations in the way the ore widens out with depth. Recent assays show the ore to carry 13% copper, $3.50 silver, and $8.50 gold. On the strength of the showing of these mines the Granby Consolidated has bought the Contact group at Tasso Harbor.——Preparations are being made by the Portland Canal Mining Co., to install an aerial tram 1½ miles long this summer. The company will also develop 500 electrical horse-power from its water-rights to be used in part to operate the 50-ton concentrator which is to be installed at once. There are about 20,000 tons of ore in the workings above the adit level, and it is estimated this will average $15 per ton. It is a 'dry' ore and will concentrate without trouble.

J. D. Brass, representing the Golden Zone Mining Co., operating near Hedley, reports strikes of good ore in the Golden Zone and the Kingston Gold & Copper mines. The first named group consists of four claims, with a shaft 100 ft. deep in which is a vein 10 ft. wide. The surface croppings are traceable for 2000 ft., and several samples have been found rich in gold. A 5-stamp mill has been installed and arrangements have been made for five more.——According to information obtained in Seattle the Nickel Plate mine on the upper Similkameen is under option to parties connected with the United States Steel Corporation. The Marcus Daly estate is the principal owner of the Nickel Plate, M. K. Rodgers, of Seattle, owning 15% of the stock.

The Hidden Creek Copper Co. is opening a copper mine on Observatory Inlet, 80 miles north of Prince Rupert. The property is situated 8000 ft. from tide-water, on a mountain that rises 1000 ft. above sea-level, and consists of a zone of copper ore 2000 ft. in length and 400 ft. wide. The ore is a sulphide, having an excess of iron, and carries an average of 5% copper with $1 to $3 per ton in gold and silver. The initial workings consist of open-cuts, adits, and drifts, amounting to 2000 ft. An 8 by 8-ft. adit, being driven 500 ft. below the other workings, is now 600 ft. in ore, showing practically the same conditions at this depth as those in the first workings. Operations have been in progress a year, and $200,000 have been spent on the work and equipment. M. K. Rodgers, of Seattle, is general manager for the company, and states that a smelting plant may eventually be erected on the property.

ONTARIO.

The structural steel head-frame of the Temiskaming company over the new shaft is completed. It rests on a solid concrete foundation and is over 70 ft. high.——The Cobalt Central company recently shipped a car of concentrate to the smelter at Copper Cliff, whose value increased $1860 between the time it left the mines and the time it had been smelted and weighed, as a result of the increase of 3c. in the market price of silver within that period. Shipments from the camp continue in large volume.

In the bottom of a 30-ft. winze sunk in the 300-ft. level of the Temiskaming mine, the No. 2 vein now shows a width of 3 ft. with silver through the entire width averaging 3000 oz. per ton.

MEXICO.

GUANAJUATO.

The gold content of the Guanajuato district ores are keeping that camp active though silver is still low. Much development work is being done in the Pinguico, Santa Rosa, and La Luz districts, particularly in the latter, as electric power can be obtained at very reasonable rates. ——The San Cayetano Mines Co. is unwatering its properties in this neighborhood. A diamond-drill is to be installed at the Ruby silver mine to try to find another vein. F. H. Clark is manager.——At the Guanajuato Consolidated Mining & Milling Co.'s mill 100 stamps are dropping, and a recently installed filter-press is giving an increased output. ——The Rapid Economy mill which has been erected for the Vignos company to treat the ore from the Tres Coronas mine is now being tested.

PUEBLA.

The water flowing through the Necaxa river is so reduced in volume, due to the unusual drought in the mountains between the Mexico valley and the State of Puebla, that there is now only sufficient to operate one of the six generators. In consequence it is necessary to burn a large amount of coal at the Mexico City power-plant. The water in the upper reservoir is exhausted, and sluicing by monitors for the construction of the new dam has had to be suspended. Work is being rushed on the Tenango river dam and tunnel, as this, when completed will turn an important watershed into the Necaxa river, and in a great measure solve the problem now confronting the company's engineers. R. F. Hayward is general manager for the company.

WEST AFRICA.

The Taquah Mining & Exploration Co. owns two mines in the Gold Coast Colony known as the Taquah and the Abosso, from which excellent dividends are being returned. The Taquah mine is working a banket reef very similar to those on the Rand. It dips at an angle of 35°, and has been developed to a depth of nearly 1000 ft. on the incline through a shaft 20 by 7 ft., with two skipways. In August 1907 a 50-stamp mill with a cyanide annex was started, and is running most satisfactorily on ore averaging 1 oz. per ton. The cost of labor is apparently low, being between 25c. and 36c. per day, but is actually high owing to its inefficiency, and is the main reason for the cost of production being about $8.50 per ton. Power is supplied by three German-made gas-producer engines, which are highly efficient and economical, effecting a saving of about 50% over the steam-driven plant. The company is said to be controlled by Ochs Bros., of London, and the mines themselves are under the management of G. A. Stockfeld.

Special Correspondence.

JOHANNESBURG, TRANSVAAL.

Stope-Drills Underground.—Annual Reports and their Merits.—Simmer Deep Ore Reserves. — Milling Experiments. — Distinctive Colored Wrappers for Explosives.

The underground elimination trials of the stope-drill competition have not run as smoothly as the preceding ones on the surface. Serious complaints have been heard as to the quality of the steel supplied—possibly because suitable tempering for the different classes of machine has not been fully determined and special requirements have not been met. Certainly the variations between surface and underground performances have been remarkable in several instances. Speeds recorded by certain drills are tabulated below, time being in inches per minute:

	Surface, In.	Underground, In.
Siskol	4.34	(1) 0.99
		(2) 1.16
Westphalia	4.21	(1) 0.99
		(2) 1.39
Flottmann	4.01	(1) 1.16
		(2) 1.09
Climax Imperial	3.52	(1) 2.17
		(2) 2.04
		(3) 1.60
Holgate	3.45	(1) 1.07
		(2) 1.16
Holman, 2¾-in.	3.11	(1) 1.89
		(2) 2.82
		(3) 2.48
Murphy	2.92	(1) 1.81
		(2) 1.76
		(3) 1.89
New Century OO	2.87	(1) 1.57
		(2) 1.71
Konomax	2.48	(1) 1.61
		(2) 1.27
		(3) 1.30

Although the indifferent results obtained underground may be variously explained, and are in part attributable to difficulties and defects for which remedies may be found, the comparatively bad work done by the first two machines is significant after their exceptional work on the granite blocks.

The majority of the annual company meetings held in respect of the operations for 1908 are now over, and it must be admitted that, for lucidity and fulness of speeches made and of reports supplied to shareholders, Rand gold-mining concerns can find few superiors in other parts of the world. But there are exceptions, and it is particularly regrettable that it should be necessary to charge even one of the strongest and technically most progressive groups with 'sins of omission'. To specify, it is deplorable to find that neither the chairman nor the engineers of the Simmer Deep, Ltd., provide detailed information as to ore reserves. The chairman in his speech remarked: "The ore reserves have been carefully checked, and at the end of the year the amount developed was estimated at 747,000 milling tons, of an average value of 6.1 dwt." After noting that certain blocks had been excluded on account of insufficient reef-exposures in the drifts, he added: "There is, of course, a considerable amount of lower-grade rock, part of which will eventually be worked at a profit." The reports do not even go so far as this. Yet the mere fact that £459,876 has been expended on development giving this result (exclusive of shaft-sinking), should enforce a full declaration of the amount of unpayable 'reef' also developed. A general reference to the 'considerable' tonnage of unpayable rock does not meet the case. These remarks are not made in a spirit of captious criticism, but only in the hope that the public expression of these views may suggest the advisability of remedying the defect. The world has often been told that the deep-level developments of the Central Rand have lately proved the fallaciousness of the theory of general impoverishment in depth. The revival of popularity in Kaffir investments has been largely brought about by the better prospects of deep-level mining, based on the results obtained in the City Deep, in the lower levels of the Village Deep as compared with the upper in the Cinderella Deep, in the Brakpan, and in other deep mines. If, however, full particulars of these encouraging developments are published and only scanty information is provided with regard to the less satisfactory features of Rand expansion, there is danger of reviving the old feelings of distrust. Both good and bad news must always be forthcoming from a mining industry of such magnitude as that of the Transvaal, and the balance has recently been so heavily in the favor of the good, that neither the Consolidated Gold Fields nor any other group need fear ill consequences from frankly presenting to the public every aspect of their position.

It is satisfactory to find that so many of the new proposals made for the improvement or alteration of methods in or below the mill are now being tried on a working scale by the Mines Trials Committee, and will therefore be tested to the widest advantage. The new organization is certainly working with energy and pluck; although it must necessarily lead to cases of dissatisfaction, by refusing to invariably share the enthusiasm of inventors and to incur expenditure on experiments of little promise, the Committee has already instituted investigations of sufficient general importance to justify its formation. Reference has previously been made to the tentative introduction of a non-amalgamation direct-cyaniding process at the old Wemmer mill of the Village Main Reef company. Another innovation of interest has lately been the employment of a Holman pneumatic stamp at the New Kleinfontein. The results of the trial should soon be known, but a long run should be made under varying conditions before conclusions are drawn. The heavy stamp experiments of the Consolidated Gold Fields extended over several years, and those who are now erecting 1500 to 1600-lb. stamps must recognize their obligations to the pioneers. The development of the heavy stamp in Rand battery-practice has been fraught with many difficulties. I understand that Mr. Caldecott is preparing a paper covering the whole question for the Institution of Mining and Metallurgy.

A question of more than local importance has lately been under discussion with reference to the use of colored wrappers for explosives. At present all the gelatine and gelignite is done up in white wrappers. Mr. Brett suggested in the Journal of the Chemical, Metallurgical & Mining Society that they should be made red, which would be more readily distinguishable from the whitish broken ore and to some extent assist in the detection of loose cartridges, thereby minimizing danger. The unexploded cartridges from partly misfired holes are not likely to be often found with wrappers attached, but bits of colored paper detected by miners or natives would act as a warning. A good deal of gelatine now finds its way to the sorting tables where it is picked out. A colored wrapper might be of service here also. As a controversy, the question raised is too one-sided to be of interest. W. W. Mein, Harry Johns, C. B. Kingstone, and a number of other authorities whole-heartedly favor the proposal, and there is only one opponent in Stuart Martin, the recently appointed consulting engineer to Eckstein & Co. Mr. Martin says he does "not think it matters very much whether the wrappers are white or red. The point is to improve supervision and prevent loose cartridges getting mixed with the broken ore." This is a counsel of perfection which scarcely meets the case. Mr. Martin is new to the fields, or otherwise his voice would probably not be heard in opposition to the opinions of all local mining men. The mere fact that the tamping of cartridges made from old newspapers, etc., are white is almost sufficient reason for adopting some distinctive coloring. It is, of course, perfectly realized that the scheme would only occasionally result in the detection of loose explosive cartridges, which would have otherwise been passed over; but anything contributing appreciably to greater safety 'mat-

ters' decidedly. An improvement in supervision is always desirable, and is a factor in the reduction of accidents from any cause; but the possibility of attaining it must not check the efforts of those in control to look to the greater safety of employees, who may be the victims of the carelessness of others. Mr. Martin seems to say that if supervision be bad, employees in the mine deserve to be literally, as well as metaphorically, blown up. Even allowing that by the improved supervision loose cartridges more rarely get "mixed in with the broken ore," would it not still be advantageous to use colored wrappers, so that (apart from the question of safety) the carelessness requiring correction could be more readily detected? Now that the mining community has expressed itself so strongly in favor of distinctive wrappers, it only remains for the manufacturers to respond to the appeal. Mr. Cullen, manager of the Modderfontein works, has had difficulty in conceiving a suitable pigment for the purpose, but this obstacle will surely be overcome.



Wemmer Mill, Johannesburg.

DAWSON, CANADA.

Cold Winter.—Preparations for Summer.—Yukon Gold.—Lewis River Dredging Co.—Canadian Klondike.—Quartz Prospects.—Strikes.—Quartz Creek —Sulphur Creek.

The past winter has been a record breaker; old timers all agree that never before have they seen such cold. Beginning with December 26, and running continuously until February 24, the average was 35° below zero. The lowest point, 72° below, was touched several times. It is hard for people farther south to fully grasp what such a continued stretch of cold weather means. It was exceptionally hard to stand, and all are glad that summer will soon be with us again. The winter has been particularly hard on all those who were obliged to do outdoor work, consequently the gold output may be expected to be lower than last year. The wood-cutters have had their share of hardship, and it is likely that they will not make much out of their contracts. Everyone, however, is cheerful and full of hope for the coming summer, which bids fair to be a busy one. No damage has been reported to any of the plants. All the dredges are in good shape, and crews are now at work clearing away the snow and ice, and overhauling machinery. The ditches, flumes, dams, and pipe-lines have all stood the winter well. The thawing plants of the Yukon Gold Co. and of the Lewis River Dredging Co. are ready to start. Enough wood has been delivered to thaw ground sufficient to keep the dredges at work until October. The Yukon Gold Co. has three thawing plants on Hunker creek, and two on Bonanza creek. These five plants will keep their seven boats busy.

Much progress has been made in thawing ground on a large scale in the past two years, and there is no doubt that future developments will bring this process to such perfection that capital need have no fear of frozen ground. The Yukon Gold Co.'s power plant on the Twelve-Mile river is being made ready for the first run of water, which is expected about the first week in May. During the past winter this plant has been enlarged one third. The machinery for this purpose was freighted from White Horse to Dawson by the White Pass Co.'s freight stages, and was landed in Dawson in splendid order. From Dawson to the power plant the machinery was moved by the Yukon Gold Co.'s own teams. Much credit is due to the management of the White Pass Co., and also to Angus McDonald, superintendent of transportation of the Yukon Gold Co., for the manner in which this freight was delivered, especially in so cold a winter. The plant will now be able to deliver 2000 hp., which is all that this company will need. There are at present about 200 men employed by the Yukon Gold Co. in clearing away the snow and ice of winter, and in generally protecting their property from the usual dangers of the spring break-up.

The Canadian Klondike Co.'s dredge, at Bear creek, is being put in shape for the summer run. This property has been in charge of Harold Brown during the winter. He will continue in charge until Fred Rothschild comes in, at the opening of navigation. Edward Simpson, general manager for the Lewis River Dredging Co., is preparing his boat for work, and also thawing ground. A good start has been made. Messrs. Milvain and McLaren are busy on Walkers Fork preparing for work. They are thawing with steam this season, a suitable plant having been shipped to their property over the ice. The Bonanza Basin Gold Dredging Co.'s boat will be ready to start as soon as weather permits. This boat made a record last year, and J. A. White, dredge master, is doing all possible to make a better showing for this season. James Wortham, the resident manager for this company, arrived a few days ago looking particularly well after a winter on the Gulf of Mexico. George H. Coffee, superintendent of hydraulics for the Yukon Gold Co., has also arrived. He is now busy getting his department in shape for the first run of water. Otto R. Brenner, general manager for the French Hill Water & Mining Co., is getting his hydraulic plant in shape. French Hill is opposite No. 16 on Eldorado, the Klondike's banner claim. The particular enrichment found here was undoubtedly due to the talus from French Hill, which is one of the richest bench claims in the Klondike. The Detroit Yukon Mining Co., for which Mr. Bender is also manager, and whose property is known as the Williams Concession on Hunker creek, has a force of men at work, opening up bedrock cuts and extending them. The water for this property comes from the head of Hunker creek. The supply is 500 in. during the wet and 200 in. during the dry season.

Excitement is rife here over the possibility of successful quartz mining. This is premature and is likely to do more real harm than good. However, there are excellent prospects, and doubtless some of these will eventually become mines. To date there are two good prospects under development, one known as the Hartman group, and the other the Lone Star, owned by Dr. Catto. These are really good prospects and are what we are banking on for the future. It will not be long before enough development work will be done to in a measure demonstrate their value. If it is successful we can then invite inspection with some assurance.

The usual spring harvest of strikes in all parts of the Territory are being discussed, much interest being centred on a find on Hubert creek, a tributary of Forty-Mile river. Joe Barrette, one of our best judges of the possibilities of a new find, panned $3 from four pans, and thinks well of the creek. Good reports are also coming from Glacier creek, where, last winter, pay was struck at an elevation considerably above the supposed limit. Glacier is one of the oldest creeks in the country, being worked before the strike was made on Bonanza creek. On the lower end of Dominion creek at Granville, several large dumps are being prepared for the spring wash-up. Camil Pissinault has about 6000 cu. yd. in his dump. Peterson Bros. and E. O. Lent have dumps equally large. These will undoubtedly turn out well. There are many smaller dumps in this locality equally rich. On Gold Run creek, Messrs. Davis and Howe, on claim No. 14, have fully 7500 cu. yd.; Henry Merles, on claim No. 13, and Messrs. Morris and McDonald have each approximately 6500 cu. yd. ready. There has been very little done on this creek during the past few years, though it has always been

rated as one of our best. There was perhaps more work on Quartz creek this winter than any year since 1903. This is due to the discovery last summer of a new pay-streak which during the winter has been heavily worked. There are more dumps in sight along this creek than any other in the district. Many of them are large. The returns will be large; possibly the largest resulting from winter work in the Klondike. The lower end of Sulphur creek has also been a busy spot this winter and those who have dumps expect a good wash-up. There is very little evidence of the ice melting in the Yukon up to date. In fact it looks as solid as it did any time this winter, the result being that the wise ones predict that it will go out much later than usual. The usual ice-moving pools are all opened up, but not many bets have so far been made. Everyone is anxious to see some action on the river before making his guess. These ice guessing contests are a time-honored custom. Men, women, and children all make bets.

NOME, ALASKA.

Litigation.—Third Beach.—Tundra Work.—Little Creek.—Dry Creek.—Nome River.—Dredging Through Ice.—Precipitation.

The 'long, dull, dreary winter' is a myth. This one has not been half long enough, and the weather is quite a welcome change after a succession of California winters. The last overland mail for the outside, which leaves here this week, finds us rushing almost as hard as we were last fall. T. M. Gibson has been mining on the Third Beach east of Nome river. W. B. Watts, connected with the management of the Wild Goose Co. from the beginning of its operations, is now in charge of the Northwestern Development Co.'s business on the Peninsula. This company controls several subsidiary companies, among which are the John J. Sesnon Co., the North Coast Lighterage Co., and the Seward Peninsula railway, besides mining property in the Kougarok district.

The suit of the Wild Goose Mining & Trading Co. against Ed. R. Dunn for trespassing on the Mabel claim on Ophir creek came up in January and absorbed attention for about three weeks. Fink's racing team was used in gathering witnesses, and in spite of a few blizzards and an average temperature of about 40 below, everyone enjoyed the excitement. The verdict went against Mr. Dunn, and damages to the amount of $3600 were assessed. The only startling feature of the trial was the production, by one of Dunn's witnesses, of an old weather-beaten diary, in which, under date of July 1900 was an entry of some survey notes that, of course, established the position of the disputed corner at the exact spot to which Dunn moved it in 1907. That this old diary, containing these very survey notes (and no others) should have lain neglected for years, to be accidentally brought to light just before this suit came up for trial, was truly a remarkable coincidence, but strange to relate it seems to have failed to impress the jury. There is a deep-seated prejudice in this country against the moving of a stake for any reason, and the usual assumption is that it is done for some dishonest purpose.

Nome is quiet, compared with the last three winters. The lull following the cessation of operations on the Third Beach, which has now been worked in a straight almost unbroken line from Little creek on the west to the head of McDonald creek on the east, a distance of five miles, has resulted in a greatly decreased demand for labor. The miners owning 'tundra' claims of unknown value are now prospecting them, and others are taking leases upon ground that in the past has been considered too low grade to work. To date no new strikes have been made—that is, nothing new in the sense that the Third Beach was new—but all of the well-known areas of concentration on the tundra have been extended, and two or three entirely new ones, carrying fairly good gravel on bedrock, have been opened up. In a great many cases several men have banded together for the purpose of working ground under lease from the owners, and, owing to the personal interest of each man in the work, it is possible for them to make good wages on ground that the large companies, hiring all their labor, could not work without loss. Most of these lessees, or laymen, are giving up 20 to 25% of the gross output to the owners of the ground, which makes the work profitable for everyone concerned. Regarding the value of the ground and the cost of working on this plan, it is difficult to obtain accurate information, but in frozen ground, under ordinary conditions, it may be said that 'three feet of 3c. dirt' is a good proposition. This means that samples taken over a height of 3 ft. show an average of 3c. per pan. Allowing five pans per cubic foot this ground is worth 45c. per square foot of bedrock, or $4.05 per cubic yard for the 3 ft. of pay-dirt.

The most active portion of the tundra lies between Dry creek on the east and a line from the mouth of Anvil creek to the mouth of Center creek on the west. Within these limits are included the Bessie, the Portland, and others almost as famous, the richest claims of the Third Beach. On several of these claims work is now being done on what is called the 'sloughover.' This streak parallels the Third Beach throughout, at a distance of about one hundred yards to the south. No rich ground has been found on it, but wherever the Third Beach was rich the 'sloughover' can usually be worked at a profit. The concentration of gold in this streak is apparently due to the formation of a bar similar in all respects to the bar that parallels the present beach outside of the surf line. On Little creek, the western limit of activity, the Pioneer Mining Co. is carrying on the most extensive operations of the entire district. Pay is being hoisted from 12 or 14 shafts by means of self-dumpers. About 175 men are employed.

North of the Third Beach line work is going on in the bed of Dry creek, and on the hillside on the right, ground of good value which is being prospected and blocked out with a view to working on a larger scale during the summer has been found at two places. Between the Third Beach line and the present beach, a distance of 3½ miles, actual mining is largely confined to a belt several hundred feet wide running from the mouth of Anvil creek almost due south to a point half a mile west of the mouth of Snake river. This belt includes practically all of the producing areas on the tundra south of the 'sloughover'; the most important ones are the Monroeville Streak, the Intermediate Beach, and the Submarine Beach. None of these streaks extends far either to the east or west of the belt mentioned. Between Bourbon and Center creeks, a mile to a mile and a half back from the beach, two entirely new pay-streaks have been found this winter, but their extent has yet to be determined. Values as high as 'five feet of eight-cent dirt' have been reported. This corresponds to about $2 per square foot, or $10.80 per cubic yard. The left limit of Center for half a mile above its mouth is dotted with dumps, and while nothing rich has been found, most of the ground will yield good wages to the laymen, who are doing nearly all of the work. East of the belt referred to, across the portion of the tundra drained by Bourbon and Dry creeks, some prospecting is being done, but no ground has been opened up which could be drifted at a profit. Still farther east, beyond Otter creek, a new streak has been found about half a mile south of the Third Beach line. Five feet of pay on bedrock is said to carry from 3 to 5c. to the pan—75c. to $1.25 to the square foot, or $4.05 to $6.75 per cubic yard. East of Nome river, on the Third Beach line, the Yellowstone claim is producing some of the best pay found this winter. One piece of ground extending about 400 ft. along the Beach line is said to carry an average value of $3 or $4 per square foot. The ground is frozen and the cost of working will not exceed 75c. per square foot. Several other operators are obtaining fair results in the same locality.

T. J. Lovett is installing an air-lift dredge, an invention of his own, on the ice of Bering Sea, a short distance west of town and several hundred feet out from the beach. He has done considerable prospecting work and claims that the gold is there and that his machine will recover it economically. It is said that the Nome Mining Co. will repair the Bourbon Creek dredge, which was started last summer, but which handled little or no gravel, owing to a series of accidents. The Wonder Creek dredge, situated about two

miles north from the Bourbon machine, was nearly completed last summer and is expected to commence operations early in the coming season. Upon the divide between Dexter and Anvil creeks, where some remarkably rich ground was worked by drifted mines in early years, several laymen are searching for pillars left in the old workings with moderate success.

A good supply of water is predicted for the coming summer. The snowfall came early, preventing the penetration of the frost to the usual depth, which means that surface workings can be quickly and easily opened up in the spring, and that the ditches will give less trouble than usual. Between the first of October and the first of March this winter the precipitation, reduced to inches of rain, was about 60%, more than for the corresponding period last winter. It is not possible to even approximate the winter's output at this time. In some places all of the available pay will have been taken out before spring, and the dump will be sluiced with snow-water during the thaw; but where the extent and richness of the ground justify it, the winter's work is being confined to blocking out pay which will be hoisted and sluiced during the summer. The prospecting work for quartz that was carried on during the winter on Newton gulch, with a Keystone drill, has been abandoned on account of litigation over the property.

GOLDFIELD, NEVADA.

Consolidated Output.—Combination Development.—Nevada Empress.

In April the Consolidated Mines produced 19,480 tons, with an estimated net recovery of $820,100; total costs of production amounting to $119,500, and the net profit $700,600. The heavier production in March was largely due to shipments of high-grade ore from the Hampton stope and of accumulated concentrate. March production was larger than for any previous month, and is not expected to be equaled regularly. During that month the mill-heads were undesirably high. Costs of production have been reduced to $5.853 per ton, divided as follows: mining $2.69, development $0.74—these items including general expense—transportation $0.103, milling, average for both mills, $2.32. The cost of reduction at the new mill was but $2.005 per ton. Over 1500 ft. of new development was completed in March, and the low cost demonstrates the high efficiency of the mechanical equipment and operating force. The mill can now treat at a profit ores as low as $7 per ton. In the Combination mine development has been chiefly confined to the Hampton stope. The vein is opened at levels 4, 5, and 6, and by means of an intermediate cross-cut, midway between the 5 and 6. A raise has connected levels 5 and 6, showing the ore to be continuous. The high-grade seam, from 4 to 6 ft. wide, was exposed 30 ft. below the 280-ft. level. Stopes on levels 4 and 5 are opened 50 ft. The production from this vein in March was 3054 tons, containing $667,347. These stopes have produced over $900,000 to date. Boy claim, the rich ore-shoot now being opened up is apparvein, is now being explored at three levels.

The cross-cut at the 600-ft. level in the Mohawk mine has been connected with the Clermont shaft on the Jumbo. The stope at the 600-ft. level, in the southeast portion of the Mohawk, has been further opened up, exposing a large tonnage of medium-grade ore, together with a shoot of high-grade. Above this an intermediate drift from the main winze is in good ore. The body increases in width to the north. A large and even production is being made from the recently developed 260-ft. level of the Red Top mine, the stopes being almost continuous for 300 ft. On the Lucky Boy claim, the rich ore-shoot now being opened up is apparently not continuous with the large stope. It is extensively faulted, but is opened for a distance of 100 ft. and contains 10 ft. of ore that averages $50 per ton. Good assays are being secured in an intermediate cross-cut above the 260-ft. level, to the west of the north drift; a discovery of importance, since this portion of the Red Top mine has heretofore been unproductive. On the Jumbo, work has been started from the Clermont shaft, and a high-power hoisting plant, designed to run by steam or electricity, has been installed, together with a 200-hp. air-compressor and drills, ore and waste bins of large capacity, and special skips.

Lessees on the Consolidated are developing a large area of virgin ground, work in March amounting to 1658 ft., and royalties in that month being $2664.45. Defects in the mill have been remedied and the entire plant is now running smoothly.

The Nevada Empress mine, in the Gold Mountain district, southwest of Goldfield, is proving successful, and its mill is satisfactory. The mine is opened by tunnels, the lowest of which is in 460 ft., and which at 700 ft. will give 700 ft. of stoping backs. Two winzes in an upper tunnel have developed 2000 tons of ore, and throughout the mine the ore carries an average of $25 per ton gold. The main vein is large and has been opened at the surface for 4000 ft. The mill is of the Hathaway gyratory type, with a muller weighing 10 tons.

The capacity of the Florence Goldfield mill will shortly be increased 50% by the addition of a tube-mill and concentrating tables. T. G. Lockhart is now in Denver, conferring with A. D. Parker and other directors. The additional machinery will be ordered at once. The physical condition of the Florence mine is excellent. Combination Fraction officials predict a May production from that mine of over $80,000. The leased Nevada Goldfield mill is treating 80 to 85 tons daily of ore averaging $38 per ton, from the Fraction. The Daisy maintains an output of 75 tons weekly, and is developing at the 400 and 500-ft. levels. Driving at the new 400-ft. level in the Velvet workings of the C. O. D. Consolidated is in ore and affords 300 ft. of backs in the rich vein from which ore was taken at the 300-ft. level.

SALT LAKE, UTAH.

John D. Ryan in Utah. — Murray Smelter Closed. — Ernest Stenger on Utah Copper Staff.—Copper Product for April.

John D. Ryan visited Salt Lake recently. He inspected the International smelting site in Pine canyon. The railroad spur from the main line of the Salt Lake route to the smelter will be completed within 10 days. Mr. Ryan announced that the initial capacity of the plant would be 2000 tons and that additions would be made from time to time to treat every character of ore placed on the market. M. S. Dean, traffic manager of the Anaconda smelter, has been appointed to a similar position with the International. The old smelter plant of the Utah Consolidated is being dismantled and a portion of the material is to be used in the new furnaces.

A strike at the Murray smelter has resulted in the closing down of the eight lead furnaces. The smelting company has shown no disposition to accede to the demand of the men for an increase in the wage scale from $1.75 to $2.25 per day. One of the big officials of the smelter says that it would be to the advantage of the institution to keep the plant closed for several months, as it is receiving only enough ore to keep five of the eight furnaces in commission, and with the improvement in metal prices shipments will increase. In the meantime a large tonnage will accumulate so that the company can place all the furnaces in commission as soon as they are again blown in. The recovery from the Murray furnaces is only 90% lead, while that at the Garfield copper plant is 95%. This condition is very unsatisfactory to the company, and it is reported that the entire Murray smelter may be overhauled.

D. C. Jackling, general manager of the Utah Copper and of the Ray Con. Mining Co., has just returned from New York after an absence of two weeks. He announces the appointment of Ernest Stenger, formerly general superintendent of the Rio Grande railroad, to the position of field engineer for the two companies. Mr. Stenger will supervise the completion of the ore line at Bingham for the Utah Copper, and the line from Kelvin, Arizona, to the Ray properties. Mr. Jackling says April was a record-breaking month for Utah Copper, it having produced over 5,000,000 lb. of copper. The Ray mill will be ready for work within 18 months. The copper output from all of the mines of Utah during April was 10,000,000 pounds.

BUTTE, MONTANA.

Diamond C. & C. Decision. — North Butte. — Sandstorm Dividend.

The Amalgamated Copper Co. has been unusually successful in the courts lately. The biggest victory was won in the celebrated smoke decision. That was followed by another in an injunction suit occasioned by débris and tailing from mines and smelters. Finally the Federal Court in Wyoming confirms the title of the Diamond Coal & Coke Co. to 2500 acres of coal land which the Government claims had been obtained by the company through fraud. The Diamond Coal Co. is a subsidiary concern of the Amalgamated company. The Government had brought a number of suits to set aside patents on the ground that the entrymen acted in collusion with the company and that the lands were not subject to entry, as they were known to contain coal deposits. The defendant company not only denied the charge of fraud, but also denied that the lands were coal lands, and seems to have proved it. Judge Lewis finds that no coal was known to exist in the ground at the time patents were issued, and that no mining was done on the ground, though coal was mined on adjoining ground up to the boundaries of the defendant's lands. The Court finds that at the time the lands were entered they were grazing lands.

The lower levels of the North Butte mine are gradually improving, both the drifts on the 2000 and 2200-ft. levels having passed through the fault, where the ore was of a low grade. The Butte & Superior Co. has resumed sinking on the Blackrock shaft, which is down 1040 ft. It will be put at least 200 ft. deeper. A level has been opened at 1400 ft. and a good body of copper and zinc ore opened to the west. The copper assays 6% and the zinc 25. The orebody will be developed, but no mining will be done on it until the shaft is deeper and another level is opened. In the meanwhile, however, some zinc ore is being shipped from the 1200-ft. and other levels, and is being treated at the Clark concentrator. The Snowstorm Mining Co. paid another dividend of 3c. per share in May.

MIAMI, ARIZONA.

Miami Development.—Black Warrior —Cordova Mine.— Inspiration. —General Development.

The Miami Copper property has stopped most of its exploratory work underground, and is cutting the orebody into 50-ft. blocks preparatory to extraction. The new 16 by 18-ft. six-compartment extraction shaft is now 350 ft. deep, and connected with the 420-ft. level of the working shaft. No further work will be done for some time at the Red Springs or Pascoe shaft, as the ground will be explored by a northeast drift from the Miami. The excavation for the new $1,000,000 concentrator is well advanced. A steam-shovel is at work, and a large gang of workmen. As the Southern Pacific railroad grade has been finished to the junction at Bloody Tanks west of Pivot creek, grading will be rapid up the level 'wash'. The road will be operating in two months.

The Black Warrior is still shipping to the Old Dominion smelter, and developing the vein in depth on the 350-ft. level, at the same time running north to connect with the ore opened to the west at the surface, 900 ft. from any underground work. The vein does not outcrop in that distance, being capped by a dacite lava, although the vein proper is in dacite tuff and in a fault breccia of schist and diabase fragment. The Cordova company has built a wagon-road up Captain gulch and has leveled off a site for its new shaft, only a few hundred feet from the Miami development shaft. Work will begin this week, and it is confidently expected that the Miami orebody will be cut at a moderate depth. The new owners of the Inspiration company have done rapid development in the few months they have had the property. They have a shaft on the Joe Burk claim, near the Miami property, that is in a mass of schist, capping granite. The shaft is now 145 ft. deep and shows much high-grade 'glance' ore, with disseminated ore averaging perhaps 3½%. The second shaft, now 185 ft. deep, on the Bull Dog claim and near the breast of the old Worson tunnel, shows only low-grade schist ore, too lean for profit. The shaft is on the east side of a by-fault, and cross-cutting should develop ore in depth. The company has built a new boarding-house and four large cottages in the gulch on the north side of the property. They have built a mile of new wagon-road, and girdled the slopes of the Miami belt. Two Star drills are at work and one hole is already over 300 ft. deep. The Keystone property is still being developed, but no information is given out. The new shaft near the east end of the property shows good chalcopyrite ore, and is now 265 ft. deep. The Last Chance tunnel is being driven by contract and is now several hundred feet long. The dump shows glance ore, but no information could be had as to its position and amount. The two churn-drills are still working, one on the very summit of the mountain ridge, the other near the shaft, where a hole 700 ft. deep is practically completed. The Lewisohn mining geologist, W. H. Weed, was seen on the property but refused to discuss it.

GUADALAJARA, MEXICO.

Guanajuato-Jalisco Development Co. — Virginia & Mexico Plant. — New Copper Smelter.—Deseada Mine.

Dwight Furness, of Guanajuato, one of the most widely known American mining men in Mexico, who has been operating in Guanajuato and Jalisco for a number of years, has launched the Guanajuato-Jalisco Development Co. to take over and further equip and develop six of the Furness properties. James C. Hinchliffe, a brewer of Paterson, N. J., is president of the company, and Mr. Furness is the general manager in Mexico. The properties are the Agua Blanca and Calabasa in Jalisco, and the Dolores, Cabrestante, San Gregorio, and Sevillana in the State of Guanajuato, and they are held to represent $500,000 in development work and $350,000 in machinery and mill equipment. The stock of the new company is divided into $1,000,000 preferred and $3,000,000 common, and it is stated that enough subscriptions have been received to insure the carrying out of the company's plans. Work is to be resumed at once in the Agua Blanca mine, and the property is to be given a new power-plant and additional pumps. The Agua Blanca has a concentrating plant of 100 tons capacity. A contract for electric-power for the Dolores mine and 40-ton reduction plant has been made, and operations will be soon in progress at that property. Later the company will turn its attention and funds to the other mines. The formation of a subsidiary company for each of the six properties, when profitable production is assured, enters into the plans of the Furness concern. The big reduction plant of the Virginia & Mexico Mine & Smelter Corporation, in the Hostotipaquillo district of Jalisco, is nearing completion, and milling operations are expected to start in June. In the beginning 150 tons of ore will be handled daily. The company owns the Cabrera, a famous *antigua*, and the Peralta and America mines, and has now a big tonnage of ore ready for the mill. W. J. Payne, of Richmond, Virginia, is president of the company, and Jesse Scobey is general manager. The reduction plant consists of stamps, tube-mills, concentrators, and a cyanide annex. It is the first of modern construction in the Hostotipaquillo district. The Copper Range Mining Co. of Chicago, C. D. DuBois general manager, has equipment for a 50-ton smelter at the Pacific port of Chamela, and will soon move it to the properties in the municipality of Purificacion, Autlán, district of Jalisco. To facilitate the movement of the machinery a wagon-road is now being built from Chamela to the mines. Development has been in progress for some time, and the company will be ready for smelting operations soon. A. J. Vick, a capitalist of San Antonio, Texas, has started to re-open the old Deseada mine in the Hostotipaquillo district. A tunnel that will give a depth of several hundred feet below the old workings will be driven, and as soon as ore supplies justify it a modern reduction-plant will be erected. A deal for the Deseada and for a half interest in the adjoining San José mine and its extensions was made several months ago. Poles for the transmission line that will carry electric power from Guadalajara to the Etzatlán and Hostotipaquillo mining districts are being distributed.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Drying coal adds to its efficiency. The contained moisture must be evaporated, and it requires 1 lb. of coal carrying 13,748 B.T.U. to evaporate 6 lb. of water.

Wood usually decreases in bulk as seasoning goes on. A hundred cords green will make from 89 to 93 cords when dry. This is a factor of no small importance to dealers who handle large quantities.

Gold stealing from reduction works has been made the subject of legislative action in the Transvaal. Among the regulations to reduce the evil is the requirement that all amalgamating plates and zinc-boxes shall be kept covered with screens securely locked.

Copper-pitch ore is a dark brown to black substance with a glassy to resinous lustre, giving a dark brown streak and having a hardness of 4. It is a homogeneous mineral of indefinite composition, containing cupric oxide, silica, carbonic acid, and oxides of other metals, as zinc, iron, and manganese, with alumina and phosphoric acid. It occurs among the products of oxidation of copper deposits in limestone. A typical locality in America is at Morenci, Arizona.

Telford road is a name applied to a method of constructing durable highways devised by Thomas Telford, a noted Scotch engineer, toward the end of the eighteenth century. The system consists in clearing the surface to secure an even bottom, upon which are closely packed by hand blocks of stone as nearly cubical as possible, about 6 in. square. The interspaces are packed with smaller stones. On top of this foundation is spread broken stone, flint being best, to a thickness of 7 or 8 in. at the centre, thinning to 4 in. on the sides. This is compacted by rolling.

Macadam is a type of road which differs from the Telford in being built up of crushed rock, unsupported by the costly foundation of hand-laid blocks. It is less durable, but admits of easy repair. It was designed by John Loudon Macadam, also a Scotchman, and a contemporary of Telford. The tendency in recent years has been to use coarser material for surfacing the roadway, as larger pieces will approximate the crushing strength of the original rock, while small pieces will reduce to powder under pressures of 500 lb. or less.

Soap is the best material that can be employed for dressing amalgamating plates. It readily emulsifies and removes the grease and oils which get into the ore from the exhaust of air-drills, from car-axles, and from the machinery used in crushing. Animal fats are employed to an insignificant extent for modern lubrication, mineral oils having taken their place. These are not affected by soda or potash lye, the utility of which is restricted to saponifying fats. Any common laundry soap gives good results in cleaning plates, but borax soap has been used in many mills with great success.

Tin ores in Bolivia are distributed in an approximately uniform course, extending from near La Paz southeastwardly to Choroloque. The tin occurs mostly in altered andesite, but some veins are associated with trachyte. The former yield the purer mineral. The veins in trachyte and slate contain antimony, copper, zinc, bismuth, and tungsten. The leading tin-producing district is at Oruro, the veins in the mountain of Huanuni being mostly notable. The Huanuni Co. is operating a vein from 2 to 8 ft. wide, from which a great deal of shipping ore containing from 20 to 50% of the oxide is sorted; the rest is crushed and concentrated.

Eight-hour legislation in California is supposed by able lawyers not to apply to foremen. The foreman's duty does not expose him as continuously to dust, fume, or gases as does that of the laborer. The foreman has duties which take him to various places, and usually require time spent in the office, making records and preparing reports. The new law, it must be remembered, is merely a police regulation, intended to protect workmen from undue length of exposure to supposedly unhealthful conditions. It is by no means certain that the California statute will be construed as applying to stamp-mills and works of similar character.

Adsorption is a phenomenon occurring under certain conditions when a salt in solution is taken up and held by colloids in a manner analogous to true solution in water. A highly concentrated solution, by reason of the intensity of the osmotic pressure, increases the adsorption effect. Van Bemmelen, however, maintains that a weak chemical combination takes place between colloids and electrolytes. The adsorption continues until an equilibrium is established between the concentration of the solution and of the colloid. Hence it has been held that the adsorption is in general an exponential function of the concentration. Metallic hydroxides are readily taken up in this manner by colloids.

Fuel required to thaw gravel may be estimated on the following assumptions: That a cubic yard of gravel in place contains 3000 lb. of solids with a coefficient of thermal capacity of 0.2, and 387.5 lb. of ice with an average coefficient of thermal capacity of 0.75; that the temperature is raised 50° F.; that a pound of coal contains 13,000 B.T.U.; that the boiler efficiency is 50%; that 75% of the heat leaving boiler is absorbed by the ground. Then heat absorbed per pound of coal equals 4875 B.T.U.; heat required to raise 3000 lb. gravel 50° equals 30,000 B.T.U.; heat required to raise 3875 lb. ice 50° equals 14,531 B.T.U.; total heat required per yard of gravel equals 44,531 B.T.U. Pounds of coal per yard, 9.1345; cubic yards gravel per ton of coal, 218.8. Then, roughly, 8 tons of coal per foot of depth per acre are required to thaw the gravel. Roughly, the heat required to thaw 'muck' is as 3 is to 2 compared with gravel; thus, 12 tons of coal are needed per foot deep of 'muck' per acre.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Short Zinc.

The Editor:

Sir—In the discussion on short zinc which has appeared in recent issues of the MINING AND SCIENTIFIC PRESS, one cause of the trouble has not been touched. The presence of even a very small amount of mercury in solution will render the zinc fragile. The mercury is precipitated from solution on the zinc, with which it amalgamates, and causes its disintegration. As most of the old tailing available has resulted from the treatment of ores by amalgamation, they generally contain some floured mercury. On weathering, this finely divided mercury becomes mercuric oxide, which dissolves at once in cyanide solution. 'Short zinc' and poor precipitation often follow from the use of dilute solutions containing no or very little free alkali. In one case coming under my observation, cyanide treatment followed directly after stamp-milling and amalgamation. Milk of lime was continuously added to the stream of pulp after it left the plates, and the sand was caught in collecting vats. After draining, the sand was transferred to leaching vats, and a first solution run on. The sand contained some concentrate (sulphides) which oxidized readily, and it was noticed that the first solution drawn off was always acid, although there was a small excess of lime in the sand. The solutions which were drawn off subsequently were in good condition, and when mixed with the first solution, a bulky flocculent precipitate came down. This precipitate coated the zinc, and the precipitation of the gold was poor. By mixing the contents of the gold tank thoroughly and regulating the amount of free alkali in the solution, the precipitation became regular and satisfactory. In many cases it will pay to run the gold tanks intermittently, that is to say, to fill one gold tank with solution, and then turn the effluent from the leaching vat to another gold tank. The contents of the first gold tank should then be agitated and brought to a suitable condition for precipitation. In most cases, this will mean the addition of the proper amount of lime or caustic soda to give that degree of alkalinity to the solution which proves most favorable to precipitation. After allowing suspended matter to settle, or after filtering it off, precipitation of the gold and silver will take place under the most favorable conditions, and 'high' sump-solution need no longer be feared.

A very interesting article by A. J. Clark appeared recently in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa (Vol. 9, p. 222), in which a comparison of results and costs in precipitating by zinc shavings and zinc-dust is given. The results quoted by him show that the cost of zinc-dust precipitation is much less than precipitation by shavings. This paper is well worth the attention of the users of zinc shavings, and should cause them in many cases to try to improve their practice. The proper equipment of the precipitation and clean-up departments in plants where zinc shavings are used has received too little attention, and in many cases only the most perfunctory care is taken of the precipitation, with the result that much zinc is wasted and the cleaning up of the boxes and melting of the bullion is unnecessarily laborious and costly.

BERTRAM HUNT.

San Francisco, May 11.

The Editor:

Sir—In your issue of April 3, F. L. Bosqui speaks of short zinc and brittle zinc as though the two were the same. There is an important distinction between the two, and the causes which give rise to their formation are quite different. Those who have had experience in the treatment of old pan amalgamation tailing are quite familiar with brittle zinc, and understand the important part it plays in the precipitation of gold from the solutions, particularly from those containing copper derived from the bluestone used in the old Washoe process. The brittleness is due entirely to the quicksilver which is recovered from the tailing and precipitated on the zinc. Within a few hours from the time the solution is turned into a freshly packed box, the shavings in the upper compartments turn white and become so brittle that a large mass can be compressed into a small compact ball. The precipitation of the quicksilver is so complete that in a 16-ft. box of nine compartments only the three upper ones will contain an appreciable amount of brittle zinc, the rest showing the brilliant hue of the copper which comes down after the quicksilver. When the zinc is thus coated with quicksilver the precipitation is complete. Boxes containing this kind of brittle zinc have to be looked after most carefully. My usual practice has been not to repack the compartments containing the brittle zinc until the zinc has practically disappeared. This point cannot always be determined by inspection, as the zinc often retains the outward shape and bulk of the original shavings.

There are probably other causes which give rise to brittle zinc, but I question their importance. Very often in cleaning up the boxes a certain amount of material of doubtful composition, having the outward form of shavings, will be found. This material is brittle and contains, among other things, certain zinc compounds formed by the replacement of a part of the original metal. This type of brittle zinc usually forms in badly packed boxes, where the circulation is poor and where the shavings have not been properly loosened previous to packing. I question whether this material can be properly classed as brittle zinc.

By 'short zinc' I mean that which is discovered in cleaning up the boxes and which ranges from a fraction up to 3 or 4 in. long. The objectionable feature about this is that it refuses to be made up into a fluffy mass like long zinc, and if replaced in the boxes in any considerable quantity it will retard the flow of the solution, and will perhaps cause the box to overflow. The material can be given an acid treatment, or may be roasted, but both of these are objection-

able. Short zinc of this character is wholly unlike brittle zinc, and refuses to break up or permit itself to be made into a compact mass by mere pressure. It is my opinion that short zinc is caused chiefly by the method employed in cutting the shavings. The greater portion of the zinc used is cut on lathes which do not produce shavings of uniform thickness. Furthermore, the lathes are so designed that in order to have a fair capacity they have to be run at such a speed that sufficient heat is generated to produce considerable oxidation. In designing a zinc-lathe, the problem is to transmit the power from the shaft on which the mandrel is mounted and around which the zinc is wound, to the screw driving the cutting tool. The mandrel revolves at somewhat more than 100 r.p.m., while the screw is driven at less than 1 r.p.m. The usual practice is to cut the speed down by a ratchet and pawl movement. This method is effective and cheap, but it has the disadvantage of imparting an intermittent movement to the screw, which in turn causes the cutting tool to advance by jerks, so that the shavings produced are not uniformly thick. Ordinary observation will fail to disclose any variation in the thickness, for the reason that the shavings are extremely thin, but a little consideration will show that the point which I bring out is correct. Another fault with most lathes is that the mandrel around which the zinc is wound has not a sufficiently great diameter, and the zinc has not the necessary time to cool before it again comes under the edge of the cutting tool. Of still greater importance is the matter of reducing the speed of the mandrel. Many manufacturers advise running their lathes at a speed of 120 r.p.m. or more. I do not know of a lathe made, with one exception, which should be run at a speed greater than 90 revolutions, while 80 would give better results. The exception which I have in mind is one which is run under ideal conditions, with special precautions to keep down the temperature of the zinc. The lathe cost something like $2000, so it is not likely to come into general use.

Not long ago I ordered a considerable quantity of cut shavings from a manufacturer, and on receipt of it I found that the shipment was made up of two lots. One of these had been cut on the expensive lathe of which I have just made mention, and the other on a lathe having an intermittent feed. This gave an excellent opportunity to compare the two kinds of shaving, so I had the zinc-boxes packed so that if there were any difference it would be clearly shown. Each pair of boxes had exactly the same grade of solution and the same quantity. On cleaning up, the box containing the zinc cut on the expensive lathe gave about four pounds of short zinc, while the other yielded about forty-five. These results were in confirmation of a point which I had long maintained, namely, that the amount of 'shorts' produced depended upon the character of the shaving. It is a well established fact that where the shaving becomes heated during the process of cutting, so that a slight oxidation has taken place, the precipitation on those shavings will be imperfect, and I will add that an excessive amount of shorts will be produced in the boxes.

I believe that the points which I have dwelt upon have long been recognized by others, for a great many companies make use of precision machine-lathes for cutting zinc shaving. To cut them on these lathes it is only necessary to put a wooden drum on a shaft held in the chucks. The speed reduction on machine-lathes is obtained by gears and worms, which causes the cutting tool to advance at a constant speed, and this produces a shaving of uniform thickness. The high cost of lathes of this type makes it impracticable for small plants to install them, but it is advisable to do so where possible. All lathes employed for cutting shaving should be carefully looked after and frequently babbited to eliminate as far as possible all lost-motion. The slightest change from a perfect alignment will cause a serious variation in the thickness of the shaving cut by the machine.

The disposal of the 'shorts' after a clean-up is a serious matter. Acid refining is expensive and troublesome, and roasting is about as bad. The way I usually handle this material, if there be any considerable quantity, is to put it into a separate precipitating tank and run strong rich solution through it slowly until the zinc practically disappears. This method is employed in zinc-dust precipitation where rich solution is run through the presses previous to a clean-up. This is not applicable to zinc shaving in the regular boxes, for the reason that only 'shorts' would be left behind, as the long zinc would dissolve first.

Short zinc is not as active as a precipitating agent as long zinc, and by careless handling during the clean-up operations its precipitating coefficient can be made zero. When the zinc is removed from the boxes it should be kept wet with either water or solution until it is replaced, and then it should be immediately re-covered with solution. When exposed to the air a rapid oxidation takes place and the zinc becomes hot. After this takes place, precipitation is slow and indifferent.

R. STUART BROWNE.

San Francisco, May 12.

William Morris Stewart.

The Editor:

Sir—I was much pleased to read in the MINING AND SCIENTIFIC PRESS of May 1 your fine tribute to the life and character of that sterling pioneer, the late ex-Senator Stewart of Nevada. You are eminently correct in stating that, as the father of the American mining law, he was "responsible for a departure from the time-worn customs of tenure in real estate that was revolutionary in principle and practice," and you have done a service to the mining men of the West in calling attention to this fact. Whatever its defects as a piece of special legislation, he was always ready with cogent arguments in its defense during his lifetime, and in his death it is only just that he should receive credit for the vast results accomplished under its provisions. The younger generation of mining engineers and operators, who had not the privilege of experiencing the humming days between 1850 and 1880, when the West was being

settled, cannot be expected to understand easily the circumstances and conditions that inspired Stewart and those back of him in fighting for such an unheard-of notion as extra-lateral property rights, and many are found in these days to condemn it as one of the most unfortunate of theories. Those who are so disposed (and generally they are not miners) should make themselves more familiar with the history of that marvelous thirty years, which transformed a rugged, trackless, and semi-arid region, half as large as Europe, and infested with savages, into a self-sustaining empire, an empire through which it was impossible to push a railroad without encountering such a flood of business that rolling stock could not be supplied fast enough to handle it. For the benefit of these 'young-bloods' among us, may I be permitted to say a few words about the American Law, and what it did for the West?

A new land needs people first, and capital later. The whole landless world is hungry for it. Given the opportunity to acquire its possession (not its usage on rental, or royalty, or any other form of servitude), and the best and hardiest spirits from every point of the compass will rush in to grasp the right; for it is a human right. It was the American homestead law that peopled the western half of the Mississippi Valley, and it was the American mining law that peopled the region from the mountains to the Pacific. Agricultural land can be found with comparative ease. Just keep on moving, with eyes open, and in due time one surely comes to a verdure-clad patch with a flowing stream by the side, that will satisfy the hunger of the landless one. Mines, however, must be painfully searched for, and they exist generally in rather forbidding regions; but give the inducement, and the prospector will appear on the scene. He also, like the farmer, deserves possession as the reward of his labor, the right to own his 'find' to the centre of the earth, the opportunity to acquire absolute title to it, as long as he pays his taxes like the rest of his fellow citizens, the right to sell it to whom he chooses, the right to deed it in perpetuity to his descendants. That was the status contemplated by the Stewart law. It was American in principle and it exhaled the doctrine of human rights in every one of its sections and lines. It brought into the West the finest bunch of humanity that ever was congregated in one place or region. It founded an industry that, though yet in its youth, is without its peer in scope, activity, and attainment in any part of the world, and it has resulted in the establishment of a group of sovereign States of unparalleled vigor and enormous wealth. The prospector was at the foundation of it all. He discovered and located practically every one of the hundreds of thousands of veins, lodes, ledges, and deposits that are now pouring out indestructible and unconsumable wealth at the rate of more than three hundred and fifty millions of dollars per annum.

Senator Stewart was the man who gave the prospector and the miner their chance. He should have a monument to his memory at every railroad gateway into the mountains, and they should be built by the miners and mining engineers and mining operators of today, who are enjoying the fruits of his broad-minded and wholly American character.

THEO. F. VAN WAGENEN.

Zacatecas, Mexico, May. 9.

Unwatering an Old Mine.

The Editor:

Sir—Referring to 'Unwatering an Old Mine', in your issue of May 8, if 'Problem' has no more data than he has given, and electric power is available (costs of other power are not given), an electric hoist will be necessary in any event. Therefore, why worry about pumps? Re-timber the working shaft as you bale it out, and, as you get more accurate data on the water flow, and other conditions warrant, calculate your pump requirements when you know your needs; but, unless there is a 'bug' somewhere, a 200-gal. bucket would enable you to approximate the location of the permanent water-level and so calculate your needs. Baling is simple, cheaply installed, nearly fool-proof. Many a mine is spending money on pipe, pumps, pumpmen, mechanics, and excessive superintendence, where a discarded skip or bucket could be adapted at small expense.

Referring again to the problem, if the mine be assumed to be half stoped out for twice the length of the 740-ft. drift, from surface to the 1000-ft. level, and for a width of 10 ft., the old workings would contain about 7,400,000 cu. ft. If it took two years to fill them, it would mean, disregarding leakage throughout the country, an average flow of 50 gal. per minute. The foreman guessed the flow at 25 gal. per minute.

Baling will probably enable 'Problem' to learn enough of this 27-year-old *antigua* to decide whether he is justified in buying an electric sinker station-pump or put in the old reliable Cornish rig, another nearly fool-proof machine.

W. H. STAVER.

Hemet, California, May 14.

Sixteen to One Mine.

The Editor:

Sir—You do an injustice, unintentionally of course, to 'Old Sierra', by locating the 16 to 1 mine in Nevada county, per editorial in your issue of yesterday, May 15. Please correct, so that Sierra county may have its proper credit for this bonanza.

DU RAY SMITH.

Oakland, California, May 16.

[By inadvertence we did credit the wrong county with the phenomenal mine which has been pouring wealth into the pockets of Mr. E. H. Wilson and his friends, and we hasten to make our apologies to Sierra county and its sturdy folk. We hope they may discover many more mines rich as the Sixteen to One. The fact is that the Sixteen to One is just across the line, so near to Nevada county that we do not need to recant our compliment. It lies within the Nevada county 'sphere of influence', and we believe as big mines may be awaiting the courageous hunter there today as rewarded the efforts of the pioneer prospectors.—EDITOR.]

TESTING DREDGEABLE GRAVELS.

Written for the Mining and Scientific Press
By William H. Radford.

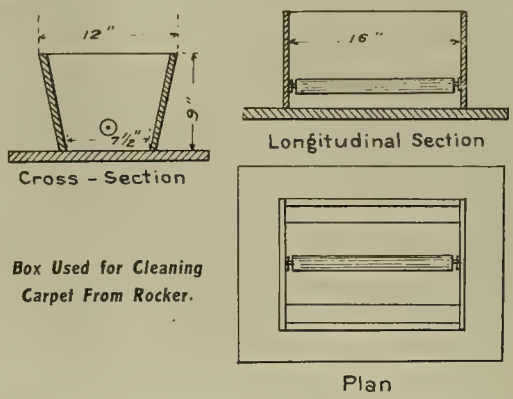
I consider dredging the safest method of placer mining, when carried on intelligently. 'Carried on intelligently'. Let this phrase form the motif for my remarks. I will assume that capital is to be invested in the dredging business, and that a property is in view that is considered attractive. An engineer familiar with dredging should be engaged to report on this property, given a free hand, take his own crew in order to avoid any chance of salting, and have no restriction upon doing the work in his own way. He should first go over the property in order to size up the situation and determine as far as possible the nature of the auriferous deposit so as to lay out his plans for prospecting. Should he find the ground full of water, testing by means of drilling machines will be necessary, but if the ground be dry, or with a light flow of water on and near the bedrock, which can be controlled by a hand-pump or by an



Drill and Washing Apparatus.

ejector, the latter plan will be by far the more satisfactory. I will assume that the ground is found to be fairly dry in the upper part and wet in the lower, as frequently occurs, and that from the engineer's superficial examination he is led to conclude that the deposit is the bed of an old river or creek. Quartz mines known to have yielded good ore exist in the mountains at the head of the valley in question, or the country rock in the range above the property consists of schistose material with numerous thin quartz seams, and features which will lead our engineer to expect something of value in the alluvial ground in the valley below. Assuming that there are no side feeders in the form of tributary creeks that formerly flowed into the main channel, the best ground should be near the head of the property, and the first hole should be put down well to the side of the supposed position of the channel. I have generally used a No. 3 traction Keystone drill for drilling purposes. The outfit should embrace the following: the drill with plenty of 'spares' in the shape of extra shoes, extra couplings, a few extra lengths of casing, a couple of extra driving blocks, bolts, an extra driving cap, at least three drilling bits, extra sand-pump, valve, and leathers for the plunger. Also a 10-ft. sluice-box, 12 in. wide, inside measurement, with sides 10 in. deep, having the bottom planed and the sides marked with saw-cuts every three inches for about four feet from the lower end of the box. These saw-cuts should extend to a height of 3 in. from the bottom, with every fourth one extending to a height of 6 in., to indicate the several foot-marks.

The sluice-box should be provided with cleats nailed to the sides at the extreme end, coming down to within an inch of the bottom, and a gate that fits loosely in the box and is held in place by the cleats.



Box Used for Cleaning Carpet From Rocker.

The object in having the cleats come down to within an inch of the bottom is to allow of the box being quickly and thoroughly swept out after each pumping. A good light rocker should be provided, 5 ft. long, with ¼-in. holes in the hopper, an apron, and a yard of brussels carpet on the bottom, held in place by three cleats, one at the head to prevent any of the sand getting under the carpet, and one at each side to hold down the edges. There is also needed a panning tub and pans, and a very fine sieve to be used for sifting out the particles of steel and iron that get chipped from the bit or casing. A hole should be dug below the discharge end of the rocker to act as a sump, so that when the pay-streak is being drilled, the tailing from it can be saved and returned to the rocker to be once more run through. As the pay-streak frequently contains a larger percentage of black sand, and occasionally coarse iron, there is a likelihood of some colors of gold being knocked off the carpet and going down into the tailing, hence the above precaution; though when I have had an experienced rocker-man I have seldom found that anything escaped the carpet.



Marked Casing.

With the drill carefully lined up and accurately set over the first point to be tested, the engineer should have his drill-man mark off the shoe-section of the casing into one foot lengths, so that he can tell the depth reached by the bottom of the shoe after driving. The length of the first section should also be marked off on the drill-stem and on the sand-pump. After these operations have been performed, he is ready to start. A hole 18 to 20 in. deep is first dug with a shovel, and a pan of dirt for each one foot of depth of hole should be thrown into the sluice-box, in order to test the ground

not drilled through. The shoe-section of the casing is placed in the hole and is driven until it is firm, and until a depth of say two feet, as shown by the mark on the casing, is reached. The material in the casing is then measured by carefully lowering the sand-pump until the foot of the pump touches the solid material. Noting the distance in the pump-column above the top of the casing, this measurement is given to the engineer in charge, who enters it in his 'log'. The material in the pipe is pumped out and emptied into the sluice-box, care being taken to wash off the sand-pumps and foot-valve after each pumping. It is next moved down to the lower end of the sluice-box and measured by means of the before-mentioned marks. This gives the engineer a check on the measurements called out to him by the drill-man, and also shows the difference that sometimes exists between the measurement in the hole and the amount of solid material actually put into the box. When drilling in material containing clay, a slime will be produced, through which the sand-pump will settle, no matter how carefully it is let down into the hole, on account of which the measurement recorded in the log will be less than the measurement of the material discharged into the box. The amount in the box is what the engineer should record in his log. It is not often, however, that this varies materially from the amount given by the drill-man. The material in the slime-box is next washed forward into the hopper of the rocker, the box carefully washed and brushed out to get every color, and the dirt is then rocked. The apron, containing the bulk of the gold, is handed to the panner, who pans out the buckets while the carpet is being taken up and washed. To expeditiously clean the carpet thoroughly it is best to use a washer consisting of a short wooden trough with a roller set near the bottom. This trough is partly filled with water, and one end of the carpet, with the nap down, is placed under the roller and run up and down two or three times. This motion opens the seams in the carpet, liberating the black sand and gold contained in them, which fall to the bottom. The box is emptied into a pan and given to the panner, who adds its gold content to what he had obtained from the apron. The 'colors' from both washings are segregated and counted, and entered in the log. While all this is going on the drill-man has driven the casing down another foot, and if necessary has cut the material up with the drill so that it can be pumped out. This method is followed until bedrock is reached. Where the gravel is tight or is coarse in character, it is better to drill ahead of the casing before driving, for if this is not done the large rocks will be forced out of the way as the casing is driven down, and whatever gravel is under the rocks and in line of the casing will be pushed out of the way and lost to that particular 'drive'. To a drive of one foot the ground should be drilled ahead for about ten inches. In the log the following should be noted: the depth from which each pumping is taken; whether the ground has been drilled ahead or not, and if so, for what distance; the amount of the drive, usually one foot at a time when in gold-bearing gravel, or several feet when in the top soil in loam, or in seams of clay; the amount of core obtained from each drive; the gold obtained, segregated into colors of various sizes; the character of the ground passed through, and the facility with which it is washed. When the hole is finished the total depth and amount of core obtained are taken and compared; if found to be alike, and if the different drivings and corresponding amounts of cores are similar, the hole is a normal one, and the value of the hole can be calculated in the usual way, namely, depth of hole in feet multiplied by 0.27 gives the theoretical cubic content in feet. Then the cubic content of the hole is to 27 as the value of the gold obtained is to the value per cubic yard. If, however, as is usually the case, the core is in excess of the theoretical cubic content of the hole, then such a proportion of the gold must be taken as the proportion existing between the ore obtained and the theoretical content. For instance, if 300 in. of hole is drilled, and 400 in. of core is extracted, and it is found from inspection of the log that the excess of core came from that part of the hole where the gold was being obtained, then ($\frac{300}{400} = 0.75$) only 75% of the value of the gold obtained should be used in the calculation of the value of the hole as given above. If, however, the excess of ore occurs in the places where no gold was found, no attention need be paid to the excess, as the value of the hole will not be affected. All this should be readily deducible from inspection of the log-book. In this case that part of the hole from the surface to 4 ft. in depth, which gave only 4 specks, is ignored; also the part from 15 to 18 ft., which was sunk in bedrock and which yielded no gold. If this method be followed, and good judgment used by the engineer in deducing results from the facts given in the log, reliable values should be obtained which should afterward be closely verified in dredging. One of the dredging companies in Oroville found, in working a piece of ground which I had drilled, that the values obtained agreed almost exactly with their drilling results, and the logs were so correct that they were kept posted in the pilot house for the guidance of the winchmen. In Montana, the Conrey Placer Co. made some careful tests, whereby a difference of only 5% was found between the dredging results and the drilling values. It is a case of 'the man behind the gun', and I feel confident that when the method outlined above is followed, and sufficient holes are drilled, the final dredging results will be found to agree closely with the drilling values. After bedrock has been reached the casing must be pulled, in order to proceed to the next hole. A contrivance known as a 'monkey-pole' will aid materially in this operation, where the casing comes up with difficulty. It consists of a pole about 25 ft. long and 10 in. wide, flattened on one side. The butt end is beveled so as to allow it to fit under a block of wood that is attached to the casing by means of a stirrup just large enough to slip over the couplings, and which will jam and hold the casing when tilted by the pole. The pulling jars are attached to the drill-rope and lowered into the casing, the block is fastened to the casing and the sand-pump rope, detached from the sand-pump, is tied to the upper end

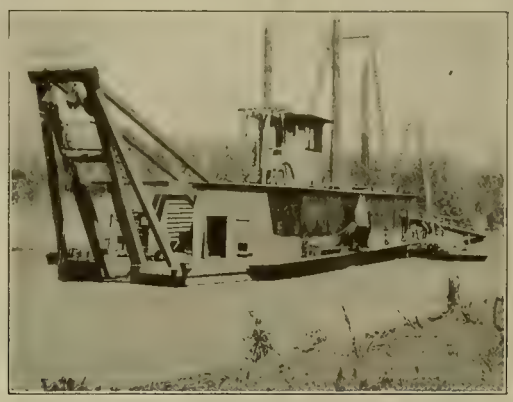
of the pole. The butt end of the pole is placed under the block, and a pillow-block, hollowed out to take the round side of the pole, is placed on the ground close up to the casing, to act as a fulcrum. The upper end is pulled until the pole forms an angle of about 20° with the ground. Two or three men walk up the pole and the pulling of the casing commences. The combined weight of the men at the end of the line, and the hammering of the pulling jars, soon starts the casing, which quickly comes up. As soon as the end of the pole touches the ground the men jump off, the pole is pulled up again, and the operation is repeated. Each time that the pole is raised the drill-man knocks down the block attached to the casing and takes a new hold with the chain tongs, to prevent the block from slipping up on the casing. After a few feet of casing are pulled it will generally be found unnecessary to continue the use of the pulling-jars, and they can be dispensed with. The remainder of the casing is quickly pulled by means of the pole alone.

Hole No. 1 being finished, and a value of say only three cents per yard being found, indicates that the



Monkey-Pole Pulling Casing.

first hole is outside the dredgeable channel. A move toward the channel of 100 ft. should be made, and hole No. 2 put down. Here I assume a value of 20c. per yard is obtained. This shows that the channel has been reached. The drill should be moved back 50 ft. and hole No. 3 put down. At this point 6c. per yard is found, and assuming that the ground is fairly loose, this may be taken as the edge of the dredging area. The drill should then be moved 50 ft. ahead of No. 2, and hole No. 4 drilled, and holes every 50 ft. put down until the limit of 'pay' is reached on the other side of the channel. Should any very high-grade holes be drilled, extra holes are needed on either side, say 25 ft. away, to determine whether there is a local patch of high enrichment or whether there is a fair width of it. If it is found to be only a patch of high-grade ground, it is safer to eliminate the high value and to substitute the average of the holes on either side of it. When the first line of holes is finished, a second line can be started 500 to 1000 ft. farther up the channel, depending upon the length of the ground to be examined. The same method of procedure is then carried out. If, however, it is known that this part of the ground is not as wet as the lower part, it will be well to put down shafts instead of drill-holes, and even if some water is found, an ejector run by steam from the boiler of the drill will be found a very efficient means of handling it. It takes up practically no room in the shaft. The shaft should be as small as possible, in order to save handling too much material, 2 ft. 3 in. by 4 ft. making a good size to work in, if the ground does not have to be timbered. It is convenient from the fact that every



Open-Link Dredge, Foot's Creek, Oregon.

three feet in depth gives one cubic yard of material. If the results of the holes in line No. 2 are somewhat better than those found in line No. 1, it is fair to assume that the channel is a normal one, and the third line can be started at the same distance above No. 2 that the latter is above No. 1. When sinking shafts, note should be made of the size of the largest rocks encountered, character of the bedrock and gravel; also the presence or absence of any beds of clay or cement-gravel. After the ground has been prospected the engineer should plot all the holes on a map, showing the boundaries of the property, and with the data in hand determine the number of cubic



El Oro No. 1, Close-Connected Dredge.

yards of material to be dredged that will yield a profit. Assuming that he has found that throughout the property the gravel is generally loose in character, free from large boulders, and that there are no beds of clay, then a dredge with 7½ or 8 cu. ft. buckets could be decided upon. Such a dredge will have a safe capacity in the above described ground of 100,000 cu. yd. per month, and a working cost, under normal conditions, of about 4c. per cu. yd. The engi-

neer can now determine quite closely the life of the property and, knowing the price to be paid for the ground, and the cost of the dredge, he can intelligently advise his principal whether he should undertake the venture or not. He can state what profit may be expected, and what amount should be set aside annually to finally reimburse original capital. Costs of 3.5 to 2.15c. per cubic yard may be obtained with varying sizes of buckets. When the gravel is mixed to some extent with clay, it is tough, but when the boulders are not large, the dredge with close-connected buckets, shaking screens, and single sluices works well, and when using a 5 cu. ft. bucket it will work at a cost per yard varying from 5.5 to 9c., depending on the toughness of the ground. When beds of clay interfere with a free-working gravel, and the boulders are not large, the close-connected bucket dredge, with buckets as free from interior projections as possible, will do the best work, and will show a cost with 5-ft. buckets of about 6c. per yard. In the latter ground the gold-saving appliances should be so arranged that when the clay is being dug it should be passed off the boat through a different set of sluices from those over which the gravel is passed. Clay, when it is plastic and rolls up into balls, will rob the riffles of gold with which it comes in contact. By adoption of the above suggestion this loss will be avoided, without interfering with the working of the dredge. The change from one set of sluices to the other is regulated by the winch-man without closing down the boat. Where the gravel contains many boulders of large size the bucket-and-link (open-connected) style of boat will give the best results, as very large boulders can be taken up in the bucket-line, as is done at Ruby, Montana. Here the last boat, No. 3, having 12½ cu. ft. buckets, and digging about 100,000 cu. yd. per month, is showing a working cost of 8c. per yard. From experience in Montana, Colorado, and California, it may be said that dredging can be carried on throughout the year in any part of the United States. In the cold climates in winter there is required the addition of steam-heating apparatus on the boat; housing in of the exposed parts of the stacker and bucket line, with flooding of the ground to be dredged. In analyzing the cost-sheets of several dredging companies I find the item of repairs very prominent; in fact, it is almost the largest item; and it occurs to me that if more attention were given to loosening up the light ground, which is the main cause of the breaks and the severe strains on the boat, a material reduction in repair costs and in the total cost per yard could be effected, partly because of the increased digging capacity. Where the ground ahead of the dredge is drilled, as is often done to serve as a guide to the dredge-master, a very slight additional expense for blasting these holes would bring about the desired result; and even where the ground is not prospected ahead, this method could be advantageously applied. Dredging, owing to the closeness with which a properly built boat will save the values (85 to 90%), is the best form of placer mining, and capital, guided by an engineer familiar with the work, can be assured of successful results.

THERMIT WELDING.

Written for the MINING AND SCIENTIFIC PRESS
By DOUGLAS WATERMAN.

The Goldschmidt thermit welding process has been in use for a number of years. While serving a great variety of purposes, its chief employment has been in the welding of rails for electric traction lines, and in repairing broken locomotive frames.

A new use has been found for thermit welding in connection with dredge mining in California. The Boston machine shop at Oroville has lately undertaken the repair of cracked and broken bucket-bottoms, gear-wheels, and other heavy castings which had been thrown on the scrap-pile. It was here that my attention was first drawn to the process. The welding has proved remarkably successful. Cracked bottoms repaired by this process have served in the bucket-line more than 90 days, and so far have shown no sign of weakness. The cost of repairing a bucket-bottom did not exceed $15. The scrapping of such a casting would have entailed a loss of $80. Those accustomed to operating in remote countries where transportation is difficult or impossible for several months in the year, will appreciate the value of a process that affords means for repairing vital parts of machinery in a day's time. It is no exaggeration to say that in many cases thermit would be worth its weight in gold.

Thermit is a mechanical mixture of aluminum and an oxide of another metal, iron being the one that is of commercial value at present. Experiments are being conducted with copper, in the hope of reducing the temperature sufficiently to avoid volatilization of the metal. That has been the difficulty in the way of thermit-copper welding.

It is possible by the admixture of suitable quantities of other metals to the thermit, to produce the best quality of the steels of those metals, such as nickel, manganese, and chrome steel. Preparations for making the various steels are obtainable. The chemical reactions are simple. The aluminum combines with the oxygen in the metallic oxide, forming a slag, and iron is set free. The heat of the reaction reaches a temperature of 5400° F., which is 2000° above the melting point of steel. It is this surplus heat that does the welding. The slag which results from the combination of the aluminum and oxygen is corundum, Al_2O_3, plus some aluminum silicate. It is equivalent to one-half, by weight, of the original thermit. Thermit itself is not combustible and may be handled with perfect safety. Once, however, that chemical action is started, the reaction progresses with great rapidity, from 20 to 30 seconds only being required for complete separation of the iron from the slag. Chemical action is started through the agency of an ignition powder. Unlike the thermit, the ignition powder is highly combustible. It is well to mention here that the tin box containing the powder should be kept covered, to protect it from the danger of flying sparks.

The apparatus required for making the weld is a gasoline torch connected to an air-receiver, and a thermit crucible. The crucible is funnel-shaped, and of a size suited to the quantity of metal required. It

is made of sheet-iron and is lined with a preparation of 'magnesia-tar'. This material greatly resembles, both in appearance and in its action under heat, the asphaltum used on city streets. A magnesia rim is inserted in the small end of the crucible, an inner mold of cast-iron placed in position, and the space of ¾ to 1½ in. between is tamped with the material, which has been previously heated in an open pan. The crucible is then dried in an oven. The shell is made thickest at the bottom, where the greatest

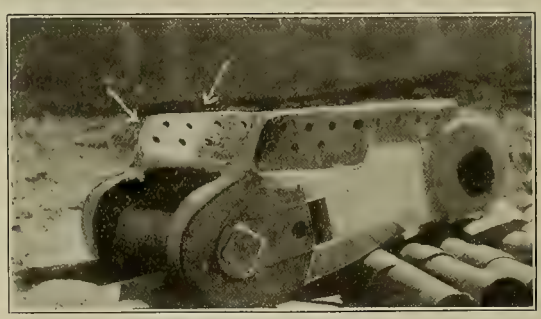


Filling the Mold; 30 Seconds After Lighting.

action is produced. In preparing for the weld a 'thimble' of magnesia is placed in the bottom of the crucible, the ½-in. hole serving as a channel through which the thermit steel is poured. A tapping-pin is suspended inside the 'thimble'; on this are placed asbestos washers, a metal disk, and a quantity of refractory sand; the crucible is then filled with the required amount of thermit. In repairing cracked or broken shafts, connecting rods, and other heavy square or round parts of machinery, it is usual to leave a collar of thermit steel, an inch or more in thickness around the weld. The number of cubic inches of metal that will be required to form the collar as well as to fill the fracture are calculated. This number multiplied by the factor 0.28 gives the weight of the steel. For small castings it is customary to use twice this weight of thermit. For large castings, where the cost of the thermit is considerable, 1½ times the weight of the steel may be taken, and the difference compensated by the addition of soft steel punchings. Any material added to the thermit should be thoroughly mixed with it, so as to produce a uniform steel. The broken parts should be carefully prepared to receive the thermit steel by thoroughly cleansing them of grease and oxide.

There are two methods of forming the mold. In the first, wax is used to fill the crack and to build up in the form of the collar. 'Green' or molders' sand is mixed as for iron founding, except that the sand which is to come in contact with the molten metal should have a larger proportion of fire-clay. The addition of powdered graphite is beneficial. A wooden box is built around the casting, and the sand is carefully tamped in place. A pouring-hole and a 'riser' are left on top, and at the bottom is a hole through which the wax can drain when melted. The success of the weld depends upon heating the casting sufficiently to prevent sudden chilling of the molten metal. To secure the necessary heat, compressed air must be used in connection with the gasoline torch. With the ordinary gasoline torch under pressure alone, insufficient oxygen is supplied to the flame—when directed through the narrow channels in the mold. Compressed air is so extensively used in mining that this method can usually be employed. If, however, compressed air is not available, the second method must be employed. In this a pattern is made and the sand is molded as in foundry practice. The casting is heated to as high a temperature as possible, by the direct application of the gasoline flame. The final preparations must be completed before the casting cools. When the mold is in place, and the crucible suspended over the pouring-hole, a match is applied to the small quantity of ignition-powder placed on top of the thermit. A metal cover is quickly placed on the crucible, and in less than 30 seconds the contents become a seething mass of molten metal. The plug in the bottom of the crucible is driven inward by a sharp blow, and the liquid metal flows into the pouring-hole, filling the mold. An emery-wheel, connected to a motor by means of a flexible shaft, is sometimes employed to finish the casting when cool.

Many examples can be cited to illustrate the adaptability of thermit-welding, and the excellent service that the process has given under severe conditions. A striking instance of its value was in the repair of a brace supporting the outer bearing of the propeller-shaft of one of the North German Lloyd twin-



Bucket Bottom Repaired by Thermit. Thermit Steel Indicated by Arrows.

screw steamers. This was welded by means of thermit five years ago, and is still in service. Locomotive frames are constantly being welded by this process, the operation occupying but two days, while at least that number of weeks would be required to repair the frame in the usual way.

The total cost of the buildings erected in the principal cities of the United States in 1908 was $546,467,390, according to Jefferson Middleton, of the United States Geological Survey. New York ranked first, the cost of its buildings exceeding those of its closest competitor, Chicago, by $50,584,582, or more than 75%. If the cost of operations in Brooklyn, the third city in rank, is added to that for New York, the total will be $163,684,622, or 30% of the cost of the building operations in 49 cities. San Francisco is fourth in rank, Philadelphia is fifth, and St. Louis is sixth. Seventh in rank is Seattle, which spent more for buildings in 1908 than Pittsburg, which was eighth, or Boston, which was ninth.

HIGH EXPLOSIVES AND SAFETY-FUSE.

By Edgar Taylor.

*Progress has been continuous and rapid in the breaking of ground, the greatest advance being the substitution of high explosives for the now almost obsolete gunpowder in blasting. In fact, it would not be too much to say that the invention of high explosives and safety-fuse mark the two most forward steps in the mining history of the last century, and to these, more than to any other cause, is to be attributed the rapid speed of development possible today.

High explosives, in contradistinction to black powder and the like, have been defined as explosives which require initial detonation, that is, the use of a detonator. It was Alfred Nobel who, prior to his invention of dynamite, conceived the idea of this initial detonation, which he first applied to nitroglycerine as early as 1864. Dynamite, which was invented in 1867, was the first high explosive used, and remained practically the only explosive of its kind until Nobel, in 1875, invented blasting gelatine. The figures given in a paper read by the inventor before the Society of Arts in May 1875 show the quantities used in the first years of the introduction of dynamite to have increased from 11 tons in 1867 to over 3000 tons in 1874. With the introduction of blasting gelatine in 1875, and the modifications known as gelatine dynamite and gelignite, the use of nitroglycerine explosives became more and more general whenever hard rock had to be dealt with.

In 1864, explosives of the 'Sprengel' type, the first representative of which was a nitrate of ammonia compound known as the 'Favier' explosive, termed in this country (England) 'Miners' Safety Explosive', were introduced, and in course of time these nitrate of ammonia explosives, of which numerous modifications were devised, have become the leading explosives in coal-getting, because of their relative safety in the presence of fire-damp. Several nitroglycerine explosives, such as carbonite and saxonite, in which the temperature of the flame is reduced either by an excess of carbonaceous substance or by the addition of salts, such as oxalate of ammonia, sulphate of magnesia, alum, etc., have likewise been added to the list of so-called safety-explosives.

The displacement of black powder and other similar mechanical mixtures, by high explosives, was concurrent with the recognition of the relative cost of the explosive, plus detonator and fuse, as compared with the cost of the bore-hole; the harder a rock the higher is the cost of the bore-hole and the more desirable it is to blast with high explosives of high density, thus obtaining the greatest amount of breakage with the least relative cost. Thus nitroglycerine explosives held their own and increased their field, while nitrate of ammonia explosives and those which, like them, are of lower density, were confined to coal-getting and workings in soft rock and stone where the bore-hole was not costly. The relative densities are roughly 1.6 for nitroglycerine explosives and 1.1 for nitrate of ammonia and chlorate mixtures, the density of tonite, which is a gun-cotton-nitrate of barium mixture, being about 1.2. It is self-evident that, the advantage of density being recognized, black powder was bound to be replaced by high explosives wherever the bore-hole was difficult to make.

The introduction and gradual development of rock-drilling machines still further accentuated the necessity of using explosives of high density and considerable strength, as it became possible to make the holes deeper and relatively less in number. Thus, for instance, mining on the Rand is almost exclusively done with blasting gelatine, which is the strongest explosive known, while in quarrying less powerful explosives are needed. The evolution in the use of high explosives is therefore essentially an economic question; although on the other hand it is of importance to remember that certain classes of rock can only be dealt with by means of high explosives, the selection of the right explosive for the particular work being therefore of considerable moment; and the relative cost of boring has always to be borne in mind.

Previous to the invention of safety-fuse the devices for conveying fire to the gunpowder charge were of the most crude and primitive description. Sometimes a small trail of fine gunpowder paper; sometimes quills plucked from geese, filled with fine grain powder, and lengthened where needful by the insertion of one quill into another; while, oftener still, rushes were used, the rush having been first split, the pith scooped out, its place filled with powder, and the two halves bound together again with fine string. The frequent accidents resulting from the use of explosives in tin and copper mining, chiefly owing to the uncertain duration of the time between the lighting of the rush or quill and the exploding of the charge, led Wm. Bickford, of Tuckingmill, in or about 1830, to turn his thoughts toward the invention of some method whereby blasting operations could be conducted with the minimum of risk to the miner. His motives were purely philanthropic; it remained for his successors to turn his invention into an extensive and legitimate commercial enterprise. In 1831, Mr. Bickford took out his first patent for 'miners safety-fuse'. His object was to provide a protected core of powder, thin and continuous, along which the fire might travel slowly at a uniform and determinate rate of speed. This result he obtained by causing a number of jute threads, passed through an orifice and stretched by means of a weight attached to their extremities, to rotate slowly, while, at the same time, a small current of fine powder fell into the tube thus formed, and was retained as a slender core. This fuse was further protected by a covering of strong twine wound thereon at nearly right angles to the former twist by an operation called 'countering'. It was then immersed in a bath of heated varnish, and a coat of whiting applied to prevent it sticking together when coiled. Subsequently it was found, for use in damp and wet places, to require an additional coat of tape, applied spirally and insulated in an extra varnish, while the exigencies of shaft-sinking

*Abstract from Presidential Address before the 18th Annual Meeting of the Institution of Mining and Metallurgy.

and other rough and wet conditions, soon suggested the addition of another coating of tape and varnish, resulting in the well known double-tape fuse. It was still in the eighteen-thirties that George Smith brought the Bickford fuse under the notice of the War Office and Royal Engineer authorities, and soon after its first adoption by the Government the advantages of the safety-fuses were also brought before a committee of the House of Commons, this being one of the earlier of the long series of examinations as to means for minimizing the danger in mines. A critical period in the history of the safety-fuse was reached when the invention of higher explosives led to the adoption of the capsule of fulminate, now termed the detonator, as a universal intermediary between the fuse and the charge. Such difficulties as were found to exist, however, were soon overcome, with the result that safety-fuse is now uniformly employed with the higher explosives as it had formerly been with gunpowder.

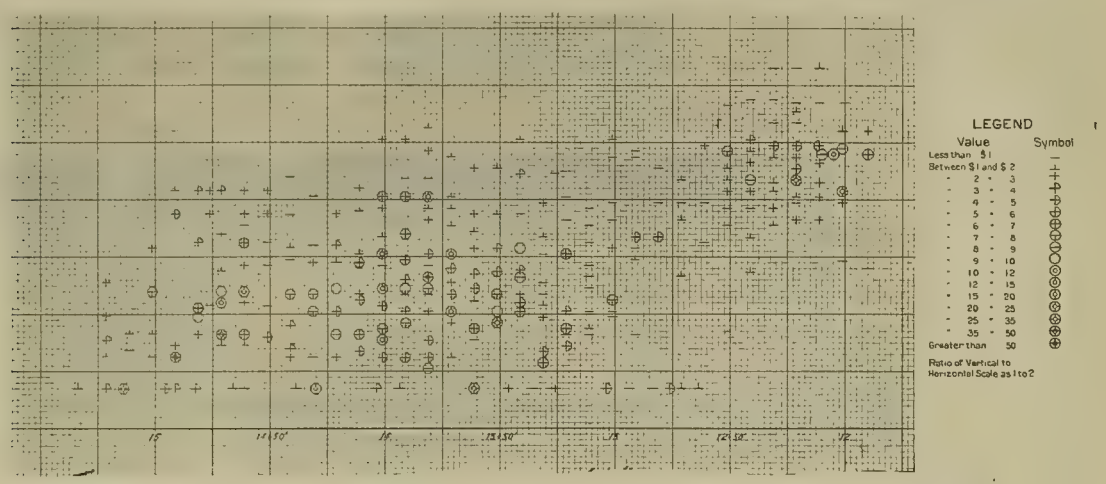
The Cruikshank gold-quartz mine in Monterey county, California, is credited with having produced $25,000 in gold, and much specimen quartz was also afforded by this mine. A Huntington mill was installed in 1887, and ran for about six months. This mine, also called the Last Chance, is in the Los Burros mining district, about 20 miles southwest of Jolon. Considerable placer gold has been taken out of the region about Jolon from gravels along the Nacimiento river and elsewhere. From the La Panza district, in San Luis Obispo county, considerable placer gold has been extracted. No gold quartz mine ever yet paid in the California coast ranges, but recent discoveries have been reported from San Carpajaro, in San Luis Obispo county. The ore is claimed to be rich. The Last Chance, or Cruikshank, cost the owners $70,000, and came into possession of the Bank of California for a debt.

Seigniorage, or profit on coinage of silver by the Government, in 1907, the last year reported, was $9,095,044. In the last 10 years the Government revenue from this source has amounted to $75,684,972.

METHOD OF PLOTTING MINE-ASSAYS.

Written for the MINING AND SCIENTIFIC PRESS
By EDWARD H. NUTTER.

The following method of graphically plotting mine-assays was devised for use at the Liberty Bell mine. It was designed with a view to correlating assays and indicating the trend of ore-shoots, so that intelligent exploration could be easily planned for unopened blocks of ground, on the basis of values found in adjoining drifts, stopes, and raises. It is required of samplers at the Liberty Bell that all of their descriptions give the co-ordinates of the points at which the samples were taken; and it is an easy matter, therefore, to plot the assays afterward. Complete descriptions are entered as well in a card-file. The vein is sampled at regular intervals as work advances, and the plotted values of these samples give a bird's eye view of their distribution in the worked portions of the vein. In the original map, different ratios of gold and silver in the assays are shown by different colors of the symbols. Thus: If gold gives over two-thirds of the value to an assay, the symbol is red; between two-thirds and one-third, blue; and less than one-third, black. The figure shows the plotted assays of a small abandoned stope in the western end of the mine. The symbols were chosen so that a sharp differentiation between mill-rock and waste could be made at once by inspection.



Method of Plotting Mine Assays.

Radio-activity of the rock passed through by the Simplon tunnel was made by Mr. Gallo, employing the Curie instrument, modified by Debiêrne, for measurements. Calcareous gypsum rocks and those comprised in the calcareous schists he found to be perfectly inactive, or very feeble in radio-activity. Orthogneiss, on the contrary, is perceptibly radio-active. The maximum dispersion was 43.2 volt-hours. Radio-activity was noted generally in rocks containing minerals like titanite, zirconium, etc. These measurements agree with those made by Borne in water from the Simplon tunnel, who found that the springs richest in emanations flow from gneiss and granites.—Rendiconti della Societa di Roma.

FAILURES IN SPUDS.

Written for the MINING AND SCIENTIFIC PRESS
By HOWARD D. SMITH.

Experience has demonstrated that a long steel beam, known as a spud, is best adapted in most cases to hold gold dredges against the gravel bank under attack. These built-up beams, shod with cast-steel shoes, are placed vertically between guides in the rear of the boat. When this beam is lowered by means of a winch until the point is firmly imbedded in the bottom of the pond, the dredge is held up to the bank, unless breakage ensues. Breakages are not uncommon, however, notwithstanding the apparently substantial construction shown. Particularly is this the case where the ground is hard and deep. After years of work, long-continued vibration tends to crystallize and weaken the steel. Careless handling, particularly attempts by the winchmen to take too big a bite of gravel bank, increases the strains to an enormous extent. The effort to take up these strains by means of coiled springs on the bolts holding the guide timbers is an important and necessary precaution. The sudden strains are absorbed by the springs and communicated to the framework of the boat gradually, lessening the severity both upon the spud and the dredge itself.

Although it is apparent that the strains to which a spud will be subjected can not be accurately forecast, care should be taken in their design to provide for them as far as possible. In the two cases illustrated the spuds show faulty design. Construction has been such as to make the spud weak near the

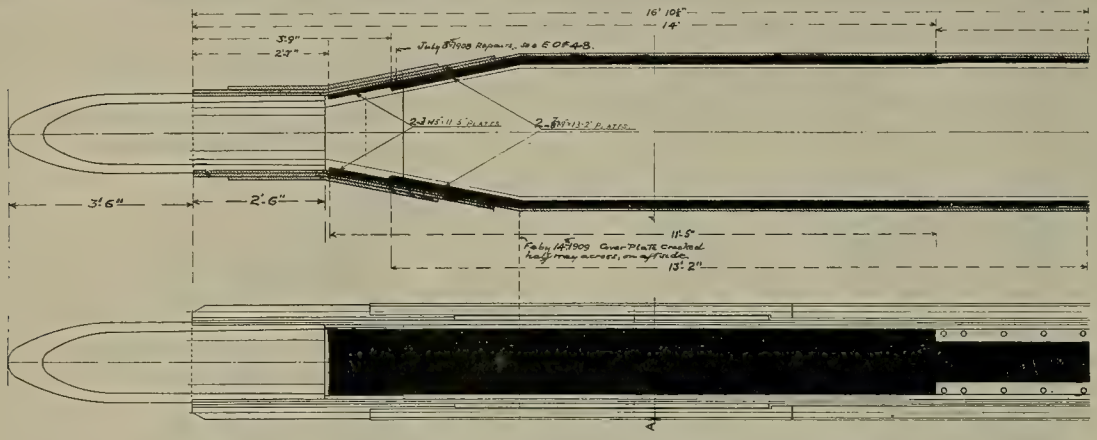


Fig. 1.

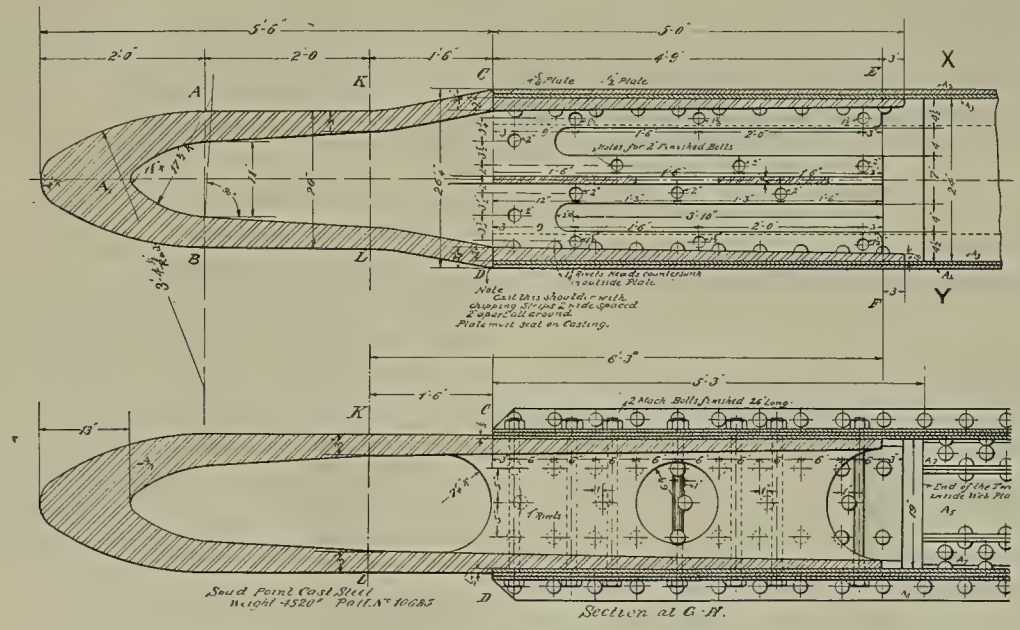


Fig. 2.

Particularly is this the case where the ground is hard and deep. After years of work, long-continued vibration tends to crystallize and weaken the steel. Careless handling, particularly attempts by the winchmen to take too big a bite of gravel bank, increases the strains to an enormous extent. The effort to take up these strains by means of coiled springs on the bolts holding the guide timbers is an important and necessary precaution. The sudden strains are absorbed by the springs and communicated to the framework of the boat gradually, lessening the severity both upon the spud and the dredge itself.

Although it is apparent that the strains to which a spud will be subjected can not be accurately forecast, care should be taken in their design to provide for them as far as possible. In the two cases illustrated the spuds show faulty design. Construction has been such as to make the spud weak near the fulcrum. This point is, of course, not fixed, but depends largely on the depth to which the point of the spud sinks in the bottom of the dredge pit. In general, however, it is near where the cast-steel point is attached to the beam proper, and consequently this is where the breakage often occurs. Fig. 1 shows a spud which was tapered excessively at this point, when it should have continued full size, or nearly so. Another defect is that the cast-steel point does not extend up far enough into the beam to make a long splice. This spud was repaired after six

months use, but may break again at the same point. Fig. 2 shows a spud which would have fulfilled its purpose except for an error in the drafting room. The rabbets in the cast-steel shoe were intended to permit the insertion of the shoe in the beam without interfering with the two main inside web plates. These rabbets were cast at right angles to their proper direction and consequently it was necessary to cut off the inside plates above the shoe, thereby making the spud only approximately half as strong at this point, where the spud actually broke.

This occurred after four years use. By this time most of the hard deep gravel had been dredged, and the spud was repaired in a manner that left it with the same strength that it originally had. This was accomplished by simply cutting off the main beam entirely on the lower end up to the break, a distance of approximately 5½ ft. The original outside plates were taken off so access could be had to the inside plates, shown in section XY, Fig. 3. These were then cut off so as not to interfere with the steel shoe which was then inserted and riveted as before. Careless riveting, in the case of even properly designed spuds, often leads to trouble. The web plates soon show signs of weakening when a rivet starts, and this is a danger to which the constant jarring exposes them.

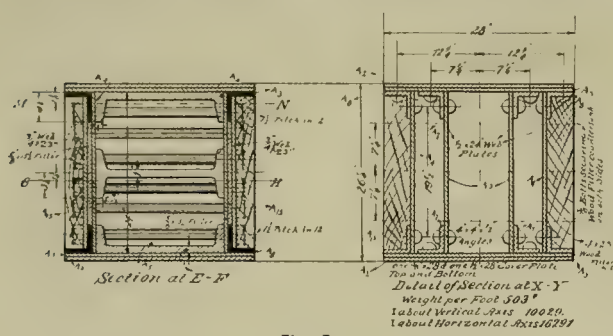


Fig. 3.

In very deep ground, torsional strains caused by the swinging of the dredge on the spud are taken care of by cross-bracing. In such ground breakage occurs some distance above the point where the spud is of uniform strength. Construction has been made heavier and heavier with the increased capacity of dredges as the result of experience, which is the only reliable guide. Now among those who know, little doubt is felt regarding spuds recently designed and installed.

The ganister quarried in Blair county, Pennsylvania, is used for making refractory brick for furnace linings. It occurs as a bed or beds in the formation known by geologists as the 'White Medina' sandstone, which forms the crests of Tussey, Lock, Loop, Dunning, and other mountains. Practically all used at present is obtained from boulders that mantle the mountain sides, having rolled down from the higher ridges. The supply available in this way is very great—luckily so, as the natural rock is difficult and costly to quarry. The qualities of ganister that make it suitable for refractory brick are disputed, but seem to depend chiefly on its greater strength.

SILVER ISLET VEIN.

Silver Islet, according to Walter McDermott, is a small island, a mile and three-quarters from land, in Lake Superior. It is a portion of a long diorite dike cropping at intervals and making islands, and the famous silver vein showed clearly under water to the northwest. Coffer-dams were sunk and the whole island was built up, and the workings were ultimately carried to a depth of 1200 ft. below water. The vein itself had two branches. The dike was faulted, and there was a branch vein, an east vein, and another vein branching to the west. At various points, to a depth of 360 ft., plumbago occurred freely through the diorite, and in the neighborhood of the plumbago the silver always occurred. Roughly, the plumbago impregnation was a pear-shaped mass, generally surrounding or near the junction of the two veins. On the various levels, down to 360 ft., the occurrence of silver was plentiful, and the production in a comparatively short length of the levels was about two and a half million dollars. The occurrences of silver were chiefly in the upper part. At 360 ft. the plumbago ceased, and the silver also practically ceased. Afterward an inclined shaft in the body of the dike was sunk to a depth from the surface of about 1200 ft. Diamond-drill holes were run in various directions, but no silver worth mentioning was found below 360 ft. where the big mass of plumbago occurred. Furthermore, it was found that the silver tended to occur where a change of rock existed. At the various points where there was a change from slate to diorite the silver nearly always occurred in valuable quantities. Going out into the slate on either side no silver of any consequence was found. The country rocks were the pre-Cambrian above the Huronian series. At about 360 ft. gas was found in the cavities in the rock, and on several occasions one or two men were burned. From one drill-hole the issuing gas burned for a length of about 150 ft. along the back of the level when first tapped. The men crawled in and plugged it, and even then it burned for a number of weeks, until the pressure was exhausted. The production of that gas and the existence of the graphite, and the co-existence of the silver with the graphite in the country rock were most striking facts. The whole history of the work at the mine showed that they had an evident connection with each other—the diorite rock, the impregnation of plumbago, the neighborhood of the branch veins—as that was the only region in which any payable ore was found. In connection with the recent discoveries of native silver at Cobalt, it was interesting to note that at the Silver Islet also nickel and cobalt and arsenic in various proportions existed with the native silver and the sulphide of silver, and with a certain amount of base minerals, zinc-blende, and galena.

It was only in the neighborhood of the plumbago that the silver seemed to enter into either the zinc-blende or the galena, perhaps merely as finely divided native silver.—(Institution of Mining and Metallurgy.)

METHODS OF COPPER MINING.

By H. Lipson Hancock.

*In any attempt to compare the practice of various places, particularly in regard to costs of mining operations, due allowance must be made for differing local conditions. In the Western States of America and in the Spanish mines, there are immense mineral deposits which enable work to be conducted on a scale impracticable elsewhere. In America wages are high, in Spain they are low, consequently in the former mechanical devices are installed wherever practicable, while in Spain not even stone-breakers are used—hand labor being cheaper. Some mines possess natural advantages not found elsewhere. Open-cut methods may be possible, or the ore may be suited to direct smelting, thus saving the preliminary costs and losses of mechanical concentration; or, as at Rio Tinto, it may be amenable to treatment by a very cheap wet process. Cheap supplies of fuel and mining timber, as well as proximity to the seaboard, are obvious advantages as affecting costs of production.

The magnitude of operations has generally a very important bearing on costs. Where circumstances justify a heavy capital outlay on machinery, labor costs will obviously be lower than where no such expenditure is justified. In smelting operations, some transport appliances which work well and afford considerable economy on a large scale would be ineffective with a smaller output, where in many cases it would be best to make intermediate products and allow them to cool, notwithstanding the expense incurred in breaking, handling, and re-melting. General charges are often the same in amount, notwithstanding the amount of work done, and thus impose a heavier burden on small than on large tonnages. Other things being equal, an increase of output tends to decrease the cost per ton treated, especially in the smelting. While it may be interesting to compare the costs of various operations at mines and smelting works, no results of value can be reached without careful consideration of all the surrounding circumstances. Judged by the only equitable standard (the nearness to the best possible results), there may be cases where the lowest cost is least creditable to those concerned. If the advantageous conditions which are often to be found in connection with mining and smelting elsewhere existed in Australia, no doubt their methods in a number of instances could be adopted by us to good purpose. In making comparisons, however, our own special circumstances have to be borne in mind.

In the Wallaroo mines the rock is heavy and treacherous. Any relaxation of precaution and the adoption of more wholesale methods of breaking would involve the greatest risk of disaster, somewhat analogous to what has twice happened recently in Eastern Australia. I observed abroad no methods of working which, in my opinion, could be substituted to advantage at Wallaroo mines. Our present method by 'stye' and filling, which has been developed as the result of our experience, is, as far as I have been able to learn, the most effective for these conditions. The only other methods available for stoping the ground, apparently, would involve more cost, and at the same time afford less security to the men.

In underground haulage, if the rock were more stable and the lodes wider, the introduction of electrical or some other mechanical system of traction might deserve consideration, but under present circumstances hand tramming is the only plan adapted to the case. The arrangements for transferring material from one bin to a lower one in the shafts, so that quantities can be hauled from any one station, is as good as can be seen elsewhere. At no mine did I find a more economical system, or one that was less liable to cause hindrance. On the contrary, some of the important mines visited might with considerable advantage adopt our methods. Without our system of bin-winzes we could not handle our material in the quantities or at the cost that we do. Our cost of mining and hauling per ton of crude ore may therefore be regarded as quite satisfactory under the circumstances. Many mines are able to do this work at a much lower cost. but this is due to certain natural advantages which we are not fortunate enough to possess.

I did not see in my travels any plant so economical for copper-ore sorting as that at Wallaroo mines, nor did I meet anywhere results equal to our own, from concentrating machinery on which so little capital outlay had been incurred. I found no appliance capable of treating the quantities and working at so low a cost as our jigging machinery, and the alternative of a multiplicity of machines, each of small capacity, with complicated classifying arrangements, involves much greater primary cost, more wear and tear, and larger consumption of power. Our other concentrating machinery as a whole compares favorably. Recrushing is always somewhat costly, whether done by ball mills, Huntingdon, Griffin, tube mills, rolls, or grinding pans. Ball mills produce less slime than do some of the other machines, which, for our work, is a great advantage. The larger or more modern plants in America are laid out in sections, each one a complete concentrating mill in itself. This arrangement serves a very useful purpose, as one or two divisions can always be kept in reserve, so that when a breakdown occurs, or machines require overhauling, the reserve section can immediately be put into commission, and repairs effected economically and without interruption to the work. While this provision would be very useful in our own works, it would involve considerably more capital expenditure, which we have always endeavored to avoid. Possibly it may be practicable at some future time to secure most of the benefit by duplicating certain parts of the plant. The percentage extraction of the copper at Wallaroo mines must be considered exceedingly satisfactory. A close watch is kept on the work done by systematic and careful sampling, and this is checked in such a way as to ensure reasonable accuracy. At Moonta mines the recovery by concentration is not so good as at Wallaroo mines, but taking into account the extraction by means of the cementa-

*Abstracted from the Australian Mining Standard.

tion process, our treatment as a whole gives a very high recovery.

The many important alterations in methods, appliances, and traffic arrangements carried out at the smelting works during the last year or two, are giving satisfaction, and the work at the sintering pots and blast-furnaces compares favorably with other places. The cost of charging the latter could be reduced by suitable bin arrangements, and larger furnaces could be utilized in the copper refining department, but the advantages are not sufficient to justify the outlay at present. In certain other departments minor improvements are being effectually made. The very important question of bessemerizing, which has long been under consideration, was the subject of very careful investigation, and there seems little doubt that it would result in considerable economy. Although the cost of electrolytic refining has been considerably reduced in recent years, it is still hoped to effect a further material reduction. The smallness of the quantities available for treatment, however, completely prevents suitable comparison with results achieved in the large American works.

In conclusion I may repeat that our heaviest costs are in the actual mining operations, and owing to the conditions under which the work has to be carried on, there is little prospect of effecting any material reduction. The recovery of metal contents in the dressing operations may be regarded as satisfactory, and the additional extraction at Moonta by cementation, although spread over a long period, forms an excellent extension of our treatment. At the smelting works the improvements introduced are giving satisfaction, and the opportunity for further material economy chiefly lies in the direction of bessemerizing. Apart from the last, our methods and appliances compare favorably with what are to be found elsewhere, making proper allowance for local conditions.

Fixation of Atmospheric Nitrogen.—F. Beck has invented an industrial process to extract nitrogen from the atmosphere. He has adopted a magnesium-tin alloy, which fixes nitrogen easily, and he recovers the substances employed. To prepare the magnesium-tin alloy, magnesium oxide is dissolved in melted carnallite, this solution being utilized as an electrolyte; the anode is carbon, and the cathode molten tin. Magnesium is formed at the cathode, which is dissolved in the tin gradually as it forms. When electrolysis is complete, nitrogen is bubbled through the molten mass, to which it is conveyed by an iron pipe coated with fire-clay. The magnesium melted in the tin is transformed into magnesium nitrite, and the tin not attacked is recovered. The nitrite is then treated with steam to produce ammonia and magnesium oxide. The latter may be again dissolved in the carnallite and, consequently, be utilized indefinitely.—Métaux et Alliages.

In the operation of the factories of the United States at the time of the last census there was required about 11,300,000 hp., of which, roughly, 77% was steam, 15 water-power, and less than 2% gas-power.

STEAM SHOVEL IN THE AMUR REGION.

*Recently M. G. Titoff, a mine owner of eastern Siberia, gave an interesting account of the installation on his property last season of a large endless-chain or bucket steam-shovel. This steam-shovel, which is to all intents and purposes a 'dry land' dredge, except that its buckets move in the opposite direction, was built at the Putiloff works in St. Petersburg and transported by rail to Sryetensk, over 5000 miles; thence by water, on barges, 400 miles to Jalindá, on the Amur; and thence hauled by horses 80 miles to the mines, on the river Urkan, a tributary of the Zea. The transportation charges were $12,500, and the steam-shovel, with two locomotives, 65 cars, a mile and a quarter of track, cost $57,500.

The chief difficulty to contend with was frozen ground. The spring was unusually late, and the steam-shovel was unable on this account to begin running at full capacity until June 23, although it started the middle of May. It ran night and day from June 23 to October 7, and handled a little over 175,000 cu. yd. It actually ran 231 eight-hour shifts,



Siberian Steam Shovel.

and averaged 762¼ cu. yd. per shift. The total product was $60,000. The pay-streak ran 42c. per yard, and the cost of working, exclusive of interest charges, was 12½c., as against 29c. by hand-labor.

The estimates for the first season called for the handling of 200,000 cu. yd., running 60c. per yard. The lower tenor is accounted for by the fact that out of 4 ft. 8 in. of overburden only 1 ft. 9 in. was stripped, and the remaining material was taken out with the pay-streak.

Because of the frozen ground, Mr. Titoff conducts his operations along a trench 700 yards in length. On the sloping face of this cut the ground will thaw from 5 to 7 in. per day, and as the steam-shovel takes two days to work its way the length of the trench, this gives time for fresh ground to be thawed 10 to 14 in. between rounds. It is necessary to strip the overburden a year in advance, and this work is well done by the same steam-shovel. It handled soft bedrock and gravel, even when considerably cemented, but found some difficulty with boulders weighing 100 to 200 lb. Altogether the machine seems to have been excellently built, and although the first season's run does not show much profit, it was creditable, considering the natural difficulties to be overcome, and a fine showing ought to be made this summer.

*Abstract from Gold and Platinum.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING PARTNERSHIP.

Several persons living at Walla Walla, Washington, made a trip to Crook county, Oregon, for the purpose of exploration, and especially for the discovery of a certain ledge of rock from which one of their number on a prior expedition had taken a piece of quartz afterward found to contain a large quantity of gold. They made a discovery of a quartz ledge which was thought to be the same ledge from which the piece of quartz was formerly taken, and several claims were located by the individuals for the benefit of all. After performing a little development work all returned to Walla Walla. Later in the year all of the members of the association except two made a second expedition, and when within a few miles of their former location one of them was given a piece of red colored quartz by a resident, who told him where it was found; other discoveries were made in the vicinity of the prior locations and some development work was done, and within a few weeks all returned home. Assays were made subsequently, and the red colored rock given to one of the parties by the resident showed gold in excess of $100 per ton. No articles of partnership were ever signed, and no specific terms definitely agreed upon. Afterward three of the original explorers, together with two strangers, organized a third expedition and went to the place where the red quartz had been found, but were unsuccessful in locating what they thought to be the identical lead. They did, however, locate a claim at this place, calling it the Silver King, and at the same time they located other claims upon the same ledge and in the immediate vicinity. The Silver King mine was found to contain valuable ore, and a corporation was formed which took over all the claims located by these particular parties. Some time thereafter the other members of the second expedition who were present at the time, one of whom had received the piece of red quartz rock, claimed an interest in the Silver King mine and in all the property of the corporation, on the ground that the former incident led to the discovery of the Silver King mine, and consequently to the property of the corporation. In an action by such remaining parties to establish their interest in the corporate property the Court held that the information obtained at the time of receiving the red quartz from the resident was not a discovery, and that it was not known at the time that the rock possessed any value, and that whatever the original understanding or agreement may have been, it could not include discoveries subsequently made by any one of the members of the association, or by any different combination of some of such members. The original partnership agreement was limited to the two expeditions originally made, and when these expeditions were at an end, the right of all the members to share in the new discoveries of any member thereof, or of any new aggregation of part of its membership with others, was also at an end. The piece of red quartz, being 'float', did not indicate the position of the ledge whence it came. It showed that a ledge probably existed in that vicinity, but there was no discovery of a ledge, and all the members were in possession of the knowledge of the finding of the piece of red quartz and as to the place or locality in which it was found. Accordingly the other members of the original expeditions had no interest in the mining property.

McGahey *v.* Oregon King Mining Co., 165 Fed. 86, Nov., '08.

ASSIGNMENT OF OIL LEASE.

Trustees appointed in proceedings to dissolve a corporation cannot bind the corporation by an assignment by them as such of a lease to drill an oil well by covenanting that they had good and lawful authority to make such assignment, but where such assignment was made without covenants of warranty.

Shannon *v.* Mastin, (Mo. App.) 114 Southwest. 1127. Jan. '09.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

MINING LAWS OF IDAHO. Compiled by F. Cushing Moore, State Inspector of Mines. 8vo., pp. 30. 1909.

INVESTIGATIONS RELATING TO CHATS IN 1908. By George C. Matson. Bull. 380-K. U. S. Geol. Survey. 1909.

INVESTIGATION RELATING TO LEAD AND ZINC IN 1908. By Waldemar Lindgren. Bull. 380-C. U. S. Geol. Survey. 1909.

INYO COUNTY, CALIFORNIA. Issued by Big Owens Valley Chamber of Commerce. 8vo., pp. 50. Bishop, California.

ADMINISTRATIVE REPORT FOR 1908. By H. Foster Bain. State Geological Survey [Illinois]. 8vo., pp. 37. Urbana, 1909.

BIENNIAL REPORT OF STATE GEOLOGIST. By H. A. Buehler. Missouri Bureau of Geology and Mines. 8vo., pp. 59. Jefferson City.

INVESTIGATIONS RELATING TO SALINES IN 1908. By Ralph Arnold and H. R. Johnson. U. S. Geol. Surv., Bull. 380-L.; pp. 5. 1909.

GEOLOGY OF MORGAN COUNTY. By C. F. Marbut. Missouri Bureau of Geology and Mines. 2 Ser., Vol. 7. 8vo., pp. 97, map. Jefferson City.

GEOLOGY OF PIKE COUNTY. By R. R. Rowley. Missouri Bureau of Geology and Mines. 2 Ser., Vol. 8. 8vo., pp. 122, map. Jefferson City.

Commercial Paragraphs.

The WOOD DRILL WORKS, of Paterson, N. J., has a number of copies of an enlarged sectional cut of the Wood rock drill which it is distributing gratuitously among mining schools.

FALKENBURG & LAUCKS, assayers and metallurgists at Seattle, Washington, have moved their office and laboratory to First avenue and Yesler way, where they have excellent quarters.

THE CYCLONE DRILL CO., Orrville, Ohio, advises that W. H. Rukenbrod, who for the last twelve years has been connected with the Standard Oil Co., is now affiliated with the Cyclone Drill Company.

THE FOOS GAS ENGINE CO., Springfield, Ohio, advises us that the city of Bellevue, Iowa, has recently ordered a Foos three-cylinder, vertical engine, with gas producer, to replace a steam engine in the city electric light plant.

THE SULLIVAN MACHINERY CO. has moved its San Francisco office from 26 Fremont street to 461 Market street. Sullivan air compressors, diamond drills, rock drills, and other mining machinery are carried in stock at this office.

A contract has just been signed between the Joshua Hendy Iron Works and the Trinity River Mining Co., to furnish a complete hydro-power pumping plant, elevators, giants, pipeline, etc., for the company's mines near Lewiston, Trinity county, California.

The HUNT FILTER CO., San Francisco, advises us that it has recently sold a standard 50-ton Hunt filter to the National Mining & Leasing Co., of Spokane, Wash. The machine will be used on the property of that company, 17 miles from Sumpter, Oregon. The offices of the Hunt Filter Co. have been moved to 518 California street.

Catalogues Received.

The INTERNATIONAL STEAM PUMP CO., New York, has just published three new bulletins covering volute centrifugal pumps, triplex house tank pumps, and boiler feed pumps.

The AMERICAN SPIRAL PIPE WORKS, Chicago, has just issued an attractive circular illustrating the adaptability of Taylor's spiral riveted pipe for mining and power purposes.

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EDITORIAL.

MULE-BACK transportation figures prominently on another page of this issue. Messrs. Roberts and Bradley present a subject that is not new, but just because it is so old there is reason to revive it. The conditions of modern metallurgical work impose new burdens on the patient mule; he has to stagger under loads that grow heavier from year to year.

CHINA has no charms for Mr. John Hays Hammond. He declines the Pekin Embassy with thanks. He is done with pioneering, so he avers. That must send shivers down the backs of the Mandarins. But Mr. Hammond has missed the opportunity of his life; no such refinements of complot were possible in South Africa as would furnish scope for his genius in the land of the Dragon.

CONTRACT work on engineering structures calls for high technical skill, and the line between engineer and contractor in places is dim. There is value, however, in maintaining the distinction, and an excellent means of doing this, and at the same time of adding dignity to contracting itself, has been found in the formation of the American Society of Engineering Contractors. It starts with a large membership and high ideals.

TWENTY years ago the probability of the growth of gold nuggets in placers furnished a theme for active discussion. Finally the 'nays' had it, and a long silence followed. But the question is now revived by Mr. F. Lynwood Garrison, and a fresh discussion of this interesting topic will ensue. Perhaps the most significant point brought out is the growing fineness of placer-gold with increasing distance from its origin. If silver be actually eliminated from the alloy, the gold grains should show greater fineness on the periphery than within. The question is worthy of re-investigation by the new generation of geologists and chemists.

NO IMPROVEMENT in metallurgy within recent years is comparable to the invention of the dry-blast by James Gayley. The Franklin Institute has honored itself by according him the Elliott Cresson medal, while Mr. Gayley has only added an ornament to the distinction of masterful achievement. The contribution to the world's economy by the efforts of this accomplished scientist consisted in showing how to do practically what other blast-furnace managers had for decades sought in vain to do. This was to squeeze out the moisture by refrigeration, and to remove it from the blast after condensation. The merit of his achievement lies in its accuracy, the moisture being eliminated so that the air contains no more than should remain at the vapor tension corresponding to the temperature of refrige-

ration. The Gayley process has cheapened pig iron $1 per ton. That effects a saving of $20,000,000 per annum for the United States alone.

POWELL'S name will always be associated with the Grand Canyon, and it is fitting that a monument to him is to be erected on the edge of the great chasm which he explored. The appropriation made by Congress for this purpose has naturally suggested the desirability of a suitable monument over his unmarked grave in the Arlington National Cemetery. A committee consisting of Messrs. W. H. Holmes, H. C. Rizer, and C. D. Walcott has undertaken to raise funds for this purpose, and subscriptions may be sent to Colonel Rizer, in care of the Geological Survey at Washington. J. W. Powell was an influential factor in the development of the West, and deserves grateful recollection by his countrymen. Many will doubtless be glad of the opportunity to contribute.

THE TWENTIETH annual session of the Trans-Mississippi Commercial Congress will meet at Denver, Colorado, August 16 to 21. This body is one of the most influential of those which yearly meet to discuss commercial conditions and public affairs. It is more nearly national in scope and character than its name indicates, but the problems of the West are always its main concern. This year the national defense, particularly of the Pacific Coast, the development of a merchant marine, and various questions relating to the public domain, are on the program. With Mr. Thos. F. Walsh as president, mining matters are sure to have a place, though these will naturally be discussed in greater fullness at the American Mining Congress at Goldfield, Nevada, August 11 to 16. These annual conferences occupy an important place in the machinery whereby American public opinion is formed and expressed—and it is public opinion that rules.

MINING ENGINEERS are coming more and more to be mine managers. There is less disposition than formerly to consider the engineer as merely the source of technical information to be tapped off and used as needed by a business head. The executive control of most large mining enterprises is now in the hands of men of technical training. Skill in management, that rare sense of when and how to compromise, of how to read and to lead men, is becoming as necessary to an engineer as a knowledge of chemistry and physics. It makes and breaks companies and establishes and shatters reputations. Just how much depends on the mine and how much on its handling is not always easily measured. At one property where about 250,000 tons per annum are mined, the directors found not long ago the profits falling off and costs mounting. For a six-month period the average cost was $3.49 per ton, the progress being steadily upward and ending with $4.21. A change in management was made. For the ensuing six months, without damage to the property, the costs were brought down to an average of $2.58, and the following year reached $2 per ton. The mine was the same, the men unchanged, the treatment was unaltered, and the market was against the second man, but he knew how to weld his force into a single unit and direct it steadily against the work to be done. In this case good management was worth approximately a quarter of a million dollars a year.

MERRY WIDOW hats have much to answer for, and virtue has been supposed to be found under the simple sun-bonnets of our fore-mothers. Millinery is, however, an economic adjunct to successful mining, at least in the South. When the Tennessee Copper Company put in converters there was great difficulty in keeping men steadily at work. In three days they earned enough to meet their simple wants, so why should they work six or seven—especially if certain of the days were cold and dreary? At such times the temptation to smoke by the fireside was almost fatal to steady running of the plant. Appeals to the men produced but little result, and a campaign of education was clearly necessary. Enter the Merry Widow. Wives of the staff dressed their best. Attractive displays were made in the stores. Wives of the men gazed and wondered. A necessity was created which resulted in a demand. To meet it six days' work became necessary to husbands and would-be heads of households. Poke bonnets are seen no longer in Ducktown, and who shall say that the dividends of this prosperous company may not be traced to the primeval love of woman for millinery.

FIRE has again scorched the Geological Survey at Washington. For the third time in six years, and for a second in as many months, the immensely valuable records of this branch of the Government Service have been barely saved from destruction. Following the blaze of last December, the House Committee on Appropriations proposed a suitable fire-proof structure for the Survey and related Bureaus. This, being subject to a point of order, was defeated by Mr. James R. Mann of Chicago, who refused the necessary unanimous consent. His reasons, as given in the *Congressional Record*, were the acme of cynicism. In effect, he excused his action by stating that sometime earlier Congress, yielding to popular demand, had gone so far as to purchase a site for a Hall of Records, and that thereupon the popular demand had subsided without insisting on the building. The implication was that if Congress would only stand firm and unafraid, the demand for a building for the Geological Survey would likewise subside. Possibly this experienced observer of public affairs is right, but one may wish, at least, that public business be conducted on a more rational basis than of alternately resisting and yielding to clamor. Every mining district in the United States has a direct interest in seeing that the notes and unfinished work of the Geological Survey be protected from fire. The records could not be replaced, and the incomplete work would cost time and much money to reproduce. In many cases the maps have been partly paid for by direct appropriation by the States, and no insurance is carried. The interest on the money invested in a building would amount to less than the rent now being paid. It is certainly a peculiar mental attitude which leads a Congressman

to obstruct a plain business move merely until he shall be hammered by letters and telegrams. Mr. Mann has been right on too many questions to permit such an attitude to go unexplained. If he has better reasons we would be glad to know them.

Mine Inspection and Geological Surveys.

Mine inspection has not generally been a function of geological surveys in America. In a few States the two services are joined, and for the last few years the mine inspectors in the Territories have been to some extent under the direction of the Technological Branch of the United States Geological Survey. In the main, however, the position of mine inspector has been more or less frankly recognized to be in politics, and political affiliations have been given more weight than technical skill in appointments. Despite the large and increasing number of technical graduates, and the importance to the industry of having well trained men, not many inspectors are graduates of schools of mines. There are better reasons for this than at first appear.

The mine inspector is primarily an officer charged with the duty of enforcing the law. In most States he has very little discretion and must take the law as it is and apply it to the particular facts before him. This requires sound judgment rather than refined technical skill. To bring men to accept his decisions and to obey his orders without constant friction, places a premium on leadership in preference to book-knowledge. Furthermore the inspector must have the confidence of the working men, since the time has gone past when his main trouble was with the operator. Companies have too much at stake and their officers are too well informed, to take any unwise chances. With the men it is different. Many of them are ignorant and foreign to our ways of thought. They do not see far into the future, and a conscientious inspector has before him the task of bringing them to accept rules necessary to their own safety. It is this which has made our politically chosen inspectors so generally successful; for as a matter of fact mine-inspection service in America, with all its admitted defects, is far from being as badly conducted as critics would have us believe. Under a system of political appointments the inspector is almost certainly a man who is, or has been, a miner; he therefore thoroughly understands and appreciates the miner's point of view. Furthermore, he is a leader, for men do not rise in politics without the gift of influencing men. Given good laws and such material, and an excellent inspection-service is made possible. This is not saying that it has always been realized. The modern political party is a chain of obligations, and officers owing their position to political favor are by no means always free or fearless.

Where mine inspectors are subordinate to the State Geologist, it results in the latter and the whole geological survey being forced into politics. A service which demands first of all the detached impersonal point of view of a technical investigator, must then take into account the times and seasons in announcing results, if not indeed in reaching them. This is bad for the Geological Survey, and it is by no means certain that the inspection is improved. This may be fairly said without any disparagement of geologists, official or otherwise. Geological investigations and mine-inspection call for such different training and experience, and such diverse mental attitudes that a man may well succeed in one and fail in the other. It is true that Mr. C. J. Norwood, in Kentueky, does well in both, and that there are other exceptions, which, as usual, but serve to prove the rule. In Indiana the State Geologist, who appoints the inspectors, is nominated on a party ticket, pays political contributions, and the office is a part of the political spoil. That Mr. W. S. Blatchley has done good work, has been in spite of the system and not because of it. He has succeeded in getting rid of the appointment of oil inspectors, and possibly in time the Geological Survey there, as in other States, will be made non-political.

Mr. Herbert S. Hadley, the brilliant and militant Governor of Missouri, last winter recommended that the appointment of State mine inspectors be placed in the hands of the State Geological Board. He showed his good faith by making appointments subject to approval of that Board in case his recommendation was adopted by the Legislature. That the inspection-service in Missouri is capable of considerable improvement may be readily granted. Whether his recommendation was the only or the best way of meeting the difficulty is not so certain. If better inspection is really wanted it would seem necessary to appoint better men and to raise the pay so as to keep them, and to build up a strong public opinion favorable to good service. In the long run a State gets the kind of service in mine-inspection, as in other things, that public opinion demands, and appointing inspectors through a commission instead of directly, is only valuable as a declaration of policy, especially in Missouri, where the Geological Board can be, and in the past has been, dominated by a Governor wishing to make all appointments on a political basis.

The immediate effect of the Governor's recommendation has been to make trouble for the State Geologist. He is accused of having attempted to capture the inspection-service. Under cover of this criticism disappointed boomers of worthless enterprises, and speculators in land of uncertain value, are making a fight against the Survey. It should not succeed, for, despite all the vicissitudes through which the Geological Survey of Missouri has gone, it has done much excellent work and deserves support. More than all else it needs continuity of plan and effort, and the present Director should be given a reasonable opportunity to carry out his plans.

As to the larger question of the control of mine-inspection service, there are obviously two sides. Politics should not be allowed to interfere in the work of the office, but to hold that a man can not be a politician and yet an efficient officer and a good citizen would be to despair of American institutions. What we need is not to take places out of politics, but to change the character of party management and to educate public opinion as to what 'political obligation' may consistently involve.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

S. J. Speak is in West Africa.

H. C. Beeler is in San Francisco.

D. C. Jackling is at Los Angeles.

E. M. McCormick is at New York.

W. H. Shockley has gone to London.

James F. Callbreath is at Washington.

Howard Du Bois is in British Columbia.

D. M. Monro is enjoying a holiday in Scotland.

H. Kilburn Scott, of London, is in Nova Scotia.

U. S. Grant sails for Valdez, from Seattle, June 8.

G. W. Traer has been at Pittsburg, Pennsylvania.

R. M. Torin, of the Kleinfontein Mines, is at London.

Robert Syson has returned to London from Australia.

J. Morgan Clements was at Cananea, Mexico, recently.

W. A. Scott sailed from Seattle for Ketchikan, May 21.

Edgar Rickard sails for London from New York, May 29.

F. Lynwood Garrison will go to Silverton, Colorado, in June.

Frank Merricks has left London for Nova Scotia and Mexico.

S. F. Emmons has returned to Washington from Cobalt, Ontario.

Carney Hartley is examining placers in northwestern Colorado.

R. Gilman Brown is in West Africa. He is expected at London June 10.

Herbert Lang has returned to Oakland from Mariposa county, California.

Carl A. Allen has returned to Denver from the Black Hills, South Dakota.

T. A. Rickard has been at Washington and Philadelphia, on his way to London.

Henry P. Lowe, of the Frontenac mine, Gilpin county, Colorado, has gone to London.

Heinrich Ries will report on the clays of the Dominion for the Canadian Government.

P. S. Inskipp is inspecting the properties of the British South Africa Co., in Rhodesia.

Victor Rakowsky, of Duluth, Minn., is superintending concentrating tests at Dallas, Texas.

Alexander E. Outerbridge, Jr., has returned from Jamaica, to Philadelphia, Pennsylvania.

H. B. Price, recently manager of the Crown Reef, has joined the staff of the Rand Mines, Ltd.

L. M. Louis is superintendent for the Round Mountain Mining Co., at Round Mountain, Nevada.

W. Rowland Cox is examining mines in northern Mexico for the A. S. & R. Co. and other interests.

A. J. Brett, formerly manager for the Treasury G. M. Co., is assistant manager of the Crown Mines.

T. Kerr, recently manager of the Jumpers mine, has assumed the management of the Benoni Consolidated.

C. Colcock Jones is examining placer properties at Manhattan, Nevada, in the interest of Los Angeles clients.

W. W. Leach, of the Canadian Geological Survey, has gone to the Skeena River district, in British Columbia.

Ben. B. Lawrence has returned to New York from a periodical visit to the Kerr Lake mine, at Cobalt, Ontario.

John Hays Hammond delivered the commencement address at the School of Mines, Golden, Colorado, May 28.

A. W. G. Wilson has accepted an appointment with the Mines Branch of the Department of Mines, Ottawa, Canada.

J. C. Vivian, of the Rio Tinto Mines, has been appointed underground manager of the Great Boulder Perseverance, at Kalgoorlie, Western Australia.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, May 27.

Antimony	12—12¾c	Quicksilver (flask)	44—45
Electrolytic Copper	15¼—16½c	Spelter	6¼—7c
Pig Lead	4.55—5.50c	Tin	32—33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 20. £ s. d.	May 27. £ s. d.
Camp Bird	1 3 3	1 2 0
El Oro	1 6 3	1 6 3
Esperanza	3 3 0	2 19 0
Dolores	1 10 0	1 10 0
Oroville Dredging	0 12 9	0 13 9
Mexico Mines	5 12 6	5 10 0
Tomboy	1 2 6	1 2 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver. per oz.
May 21	12.94	4.31	5.18	52¾
" 22	12.94	4.31	5.18	52½
" 23	Sunday.	No market		
" 24	12.94	4.31	5.20	52⅝
" 25	13.00	4.31	5 20	52¾
" 26	13.07	4.31	5.23	52⅝
" 27	13.19	4.31	5.23	52¼

MINING QUOTATIONS—NEW YORK.

	Closing Prices. May 20.	May 27.
Amalgamated Copper	82	85
American Smelting & Refining Co	92¾	93¾
Boston Copper	14¾	15½
Butte Coalition	25½	26½
Cumberland-Ely	8 1/16	8 9/16
Dolores	5	5¼
El Rayo	2	2
Giroux	7⅞	7⅞
Greene-Cananea	10½	10⅜
Indiana Sonora	3⅛	3
La Rose	7¼	7 9/16
Miami Copper	15⅛	15⅛
Nevada Consolidated	23	22⅜
Newhouse	2⅝	2⅝
Nipissing	10⅜	10⅞
Ohio Copper	6⅜	5⅝
Tennessee Copper	41⅝	41
Utah Copper	51⅛	51⅛
Yukon	4¾	5 1/16

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. May 27.		Closing Prices. May 27.
Adventure	9⅞	Mass	17¼
Ahmeek	160	Mohawk	66
Allouez	40½	North Butte	57½
Arcadian	5	Old Dominion	54¾
Atlantic	9½	Osceola	135
Calumet & Arizona	103	Parrot	35¼
Calumet & Hecla	655	Santa Fe	2½
Centennial	33	Shannon	15⅞
Copper Range	81¾	Superior & Pittsburg	14½
Daly-West	8	Tamarack	70
First National	——	Trinity	13¾
Franklin	15¾	United Copper Con	11¾
Granby	105	Utah Con	41
Greene-Cananea, ctf	10⅜	Victoria	5¼
Isle Royale	27¾	Winona	5½
La Salle	14	Wolverine	147

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, May 27.

Atlanta	$ 15	Mayflower	$ 12
Belmont	83	Midway	25
Booth	17	Montana Tonopah	73
Columbia Mtn	11	Nevada Hills	1.30
Combination Fraction	75	Ophir (Comstock)	1.30
Daisy	32	Pittsburg Silver Peak	55
Fairview Eagle	20	Rawhide Coalition	25
Florence	3.10	Rawhide Queen	25
Goldfield Con	7.85	Round Mountain	78
Gold Kewenas	13	Sandstorm	13
Great Bend	9	Silver Pick	17
Jim Butler	15	St. Ives	10
Jumbo Extension	15	Tonopah Extension	55
Llanos Con	75	Tonopah of Nevada	7.10
MacNamara	24	West End	30

General Mining News.

ARIZONA.

COCHISE COUNTY.

A dividend of 50c. per share was declared by the Old Dominion Copper Co.——A cross-cut on the Superior & Boston property has struck ore running 14% copper. The raise from the drift on the 400-ft. level has cut the old shaft which is now being re-timbered. Frank H. Probert is consulting engineer.——Two more furnaces have been blown in by the Copper Queen. This will make a total of nine, each with a capacity of 500 tons.

GILA COUNTY.

Much development work has been laid out on the properties of the Cordova and Live Oak Copper companies. On the Live Oak property the shaft will be sunk to the adit level and a drift run to connect them.——Sinking from the 1200-ft. level of the Gem shaft of the Globe Consolidated will start within a few days.——All the openings at the Inspiration Copper Co.'s property near Globe are in ore. The showing at the Joe Bush shaft is excellent, as sulphide ore has been struck, assaying 2.9% copper. It is believed that the mine may be worked by steam-shovels, and that copper will be produced at 8c. per pound.——The Arizona Commercial Co. is making good progress with construction work. The concrete foundations for the hoist, head-frame, and power-house have been completed, and the company is starting work on the foundation for the furnace-building; much of the machinery and structural steel is on the ground. Underground work has been delayed somewhat by the heavy flow of water, which, however, has ceased to give concern, as ample provisions have been made to handle it.

MARICOPA COUNTY.

The Esperanza group of eight claims situated three miles east of the Harqua Hala mine has been purchased by R. V. LeGrand for Pasadena capitalists.——A shaft is down 63 ft. and a core-drill is being used to prospect the ground of the Alvin Development Co. of Houghton, Michigan.——Several carload lots of ore have been shipped to the smelter at El Paso by the Arizona Bouse Copper Co. from their Little Butte mine. The ore is coming from the 115-ft. level, though the shaft is down 200 ft. J. C. Denton is superintendent.——The Ray Northern Copper Co., W. B. Twitchell president, has taken over the Mayflower group of 14 claims two miles north of Ray. A force of men will be put to work shortly. About 5000 ft. of work has been done on the Mayflower claims and the workings show some good grade copper ore. The formation is similar to that on most of the adjoining properties, and can be worked at comparatively small expense by the caving process.

CALIFORNIA.

MARIPOSA COUNTY.

James F. Peck, of San Francisco, one of the owners of the group of mines known as the Mose Rogers property, situated in the Quartzburg mining district, has bonded that property to New York capitalists and work has been started. Richard O'Brien, of Hornitos, is superintendent, and J. H. Shockley, of New York, the consulting engineer. Among this group are the Washington, Franklin, Jenny Lind, No. 9, Quartz Mountain, and Pool claims. These properties are equipped with machinery and hoisting plants. Power will be obtained from the Exchequer plant on the Merced river.

PLACER COUNTY.

The Begole Mines Syndicate of Boston has an option on the Annie Laurie and the Alameda mines, about seven miles from Colfax. They are developing each property by two adits, the lower on the Annie Laurie being about 700 ft. below the old workings near the top of the hill. Both adits are in quartz of milling grade. Power for the compressor is furnished by a Pelton wheel which is driven by a water-column of 480-ft. head. The mine is equipped with an assay office, machine shop, and living houses.

SIERRA COUNTY.

(Special Correspondence).—A strong shoot of rich ore has been intersected at the El Dorado mine. The first blast uncovered ore running over $80,000 per ton. The management reports the strike one of the richest ever made in the district. H. J. Johnston is owner.——The third shipment of ore from the Sixteen-to-One mine for May has been made to Nevada City. It was valued at $125,000. The vein continues 30 in. wide and has been opened up in the main adit for a distance of 100 ft., with no indication of the end.——The adit at the Red Star is expected to intersect the Tightner vein within 100 ft. Good milling ore is coming from the main vein.——Sulphide ore assaying $125 per pound has been uncovered at the Rainbow in the raise from the adit.——Colonel W. L. Stevenson and associates of New York have resumed work at the Gold Canyon and are arranging for vigorous developments.——Eastern interests are operating the Mammoth Springs mine and developing milling ore.——The new three-compartment shaft at the Alaska is down 500 ft. and a cross-cut is advancing from the bottom of the shaft to strike the vein about 100 ft. northeast of the old workings. The mine is equipped with a 20-stamp mill, electric pumps, hoist, and compressors. George St. John is superintendent.——As a result of the recent rich strikes, Alleghany is booming. Outside capital is active and a large number of properties are receiving attention. Several cases of claim-jumping are reported.

Alleghany, May 24.

Lawrence N. Wagner has bonded the Minnie D. mine from Albert Holmes and is preparing to commence active work.——The West Point mine has been bonded for a San Francisco corporation by F. M. Phelps. It joins the White Bear and has the continuation of that channel.——John Costa, manager of the White Bear, drove an adit under the channel and raised to the gravel, which pans gold freely and is estimated to go $5 to the car.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—Forty men have been put to work at the Seven-Thirty mine by the new manager, J. H. Robeson. He intends to connect the shaft with the Phillips drift run from the Burleigh adit.——It is understood that work will be resumed in the breast of the Capital adit the first of the coming month. The bore is now in 5300 ft., and the heading is nearing the Sporting Times vein. The manager, W. M. Cooper, is adding to the working force as fast as conditions permit. In the raise being put up in the east drift on the Aetna vein a streak of ore is exposed that is 18 in. wide, and is said to assay 3 oz. gold, 18 oz. silver, and 40% lead. The capacity of the mill is to be increased by the addition of another 100-ton unit, in which, it is reported, the Malm process will be installed.——The raise being put through from the Scepter adit to connect with the Sunburst workings has progressed 110 ft., leaving only 260 ft. more to be driven. This will speedily be accomplished with the machine-drills lately installed by the superintendent, A. B. Montgomery.——Another contract is to be awarded for the advance of the Prudential adit, the portal of which is situated on Republican mountain. The bore is in over 750 ft., and from surveys another vein will be intersected within 25 or 30 ft. F. A. Maxwell is manager.——Shipments of ore from the holdings of the Waldorf Con. M. & M. Co. will be started next week, as by that time the Argentine Central railroad will be opened for traffic. There is now ready for delivery about 1500 tons of smelting ore worth from $60 to $70 per ton. It is understood that work will be started at once to re-build the concentrating plant and increase the capacity from 125 to 250 tons per day. Lumber will be taken to the seat of operations as soon as trains can reach the Wilcox adit. The machinery has already been ordered by E. J. Wilcox, the manager.

Georgetown, May 21.

GILPIN COUNTY.

Several loads of milling ores have been shipped from the Leontine mine on Quartz hill to the Black Hawk stamp-mills, for testing. The property is under lease and bond to

the German Gold & Uranium Mining Co., in which Pennsylvania capital is chiefly interested.——Gurley & Gunnell, of Denver, have taken a lease and bond on the Josephine property in Little Jenny Lind gulch, north of Apex.——Three carloads of concentrate from the Perigo mill were shipped from the Rollinsville depot of the Moffat road to the Argo smelters during the past week.——Malet & White, lessees at the Belcher mine on Quartz hill, have sunk the shaft 50 ft. this winter and are now down a distance of 180 ft., at which depth they have commenced to drift on a vein carrying gold and copper.

GUNNISON COUNTY.

The Irene group has lately been added to the Carter holdings at Ohio City. The bore already in a mile will be pushed 1000 ft. farther to undercut the Volunteer property. ——An orebody was cut in the Lookout property south of Pitkin. The quartz is of good milling grade. J. P. Miller is the owner.——J. T. Bennett is starting work on the Mountain King mine above Gothic. A snowslide carried away the pipe-line that furnishes water-power.

TELLER COUNTY.

The Trilby Mines Co., James T. Stewart, general manager, has made heavy production since the first of the month, shipping from the Trilby mine on Bull hill to the valley plants. The ore has been graded, the content varying from about 1 to 2 oz. gold per ton. The company is mining ore in several levels of the main shaft, but the heaviest tonnage is made from the ore-shoot on the main Trilby vein under development at the twelfth level. At this level the ore is broken from 15 to 20 ft. wide. A station has also been cut at the thirteenth level.——A prospecting permit, with option of lease covering a two years' term, has been secured by the Furst brothers and McBird of Victor, on the main shaft and workings of the Last Dollar Gold Mining Co., on Bull hill. The parties have commenced examination work.

Operations have been resumed on block 27 on School Section 36, on the northern and western slopes of Grouse mountain by H. P. Reiton, holding a long-time lease from the State Land Board. At an approximate depth of 50 ft., a 3-ft. vein has been exposed in the phonolite, near the granite contact, and a drift is now being carried on this vein. The quartz is from 3 to 4 ft. wide and assays well.——Shipments have been resumed from the Blanche Gold Mining Co.'s Uncle Sam fractional claim containing about 2½ acres, adjoining the Acacia company's Morning Star mine. The property was recently leased to the Morris brothers of Cameron, who are also operating a lease on the Morning Star, and the vein recently opened up by cross-cut from the 100-ft. level of the Uncle Sam shaft is the northern extension of the Morning Star vein.

IDAHO.

NEZ PERCE COUNTY.

Mill tests of copper ore from the Bullion property near Lookout, made at the Coeur d'Alene Concentrating Co.'s plant, has given satisfactory results. A ton of ore was run over the vanners and tables, giving a clean concentrate, which has not yet been assayed, but previous tests showed it to assay 19% copper, or a gross value of $38 per ton, from which must be deducted $5 per ton for freight and treatment at the smelter at Tacoma, leaving a net value of $33 per ton.——The Orofino Mining Co. has just made a strike of galena on the property. This has increased until the whole face of the drift is in ore. Arrangements for the handling of the ore are being made, and when completed shipments will be begun over the Idaho Northern.

SHOSHONE COUNTY.

A considerable impetus has been given to the whole mining industry of the western region of the Coeur d'Alene by the resumption of development in the property of the Vienna International mine which has been shut down for almost two years. Development at present is being confined to the upper levels. A splendid showing of both shipping and milling ore has been made in all the workings. Much of this ore is sorted out ready for shipment, several carloads having been taken out in the course of development. Regular shipments will commence during the coming summer.——A big strike of ore has been made in the property of the Bear Top Mining Co. in the Murray district. The ore was exposed in the raise, being run from the No. 3 to the No. 2 levels. The full extent of the orebody has not yet been ascertained.——The first shipment of ore has been made from the property of the H. E. M. Mining Co. in the Revenue Gulch district. The ore has been sent to be tested at the sampler works of the Federal Milling & Smelting Co., after which it will go to the smelter at Tacoma. The showing in the mine continues to improve, and a large amount of galena and some native silver has been exposed in the upper drift.——Owing to labor troubles shipments of ore from the Caledonia mine in the Wardner region to the American Smelting & Refining plant at East Helena have ceased. The ore is now being sent to the Tacoma plant.—— A strike of 18 in. of carbonate ore carrying about 25% galena has been made in the property of the Clear Grit Mining Co., near Delta. A small stringer was opened and drifted on for 30 ft., when it opened out to the width mentioned. The ore is improving as development progresses. ——A wagon-road is being constructed to the property of the Midway Summit Mining Co., and as soon as this has been completed about $2500 worth of machinery, including a compressor, will be installed. It is intended to drive a lower adit to work the ore showing in the upper workings. ——Development is to be resumed at once on the property of the Tucker Mining Co. near Mullan, and a contract for 200 ft. has been let. It is believed that the main lead will be encountered in about 50 ft., when the balance of the contract will be taken out in drifting. The adit is now in about 700 ft.——Development at the property of the Copper King Mining Co. has again been hampered by a flow of water. This has now subsided enougn to allow the men to resume. The adit level has been driven about 1300 ft. and progress at the rate of 8 or 9 ft. a day is being made. The adit, when completed, will be about 3000 ft. long.——The Snowstorm Mining Co. has disbursed a dividend of $45,000 for the month of May. It is believed that regular dividends will be paid from now on.——A report from Burke states that the Day Brothers and associates are planning to drive a tunnel to open at depth the ore of the Hercules, Humming Bird, Ambergris, and Tamarack & Chesapeake mines. The tunnel will start from the end of the present Humming Bird tunnel, which has already been driven about 3000 ft. It is believed that 4000 ft. more will be sufficient to tap the Hercules and Ambergris orebodies, and 7000 ft. from that point will reach the Tamarack & Chesapeake property. All of the mines named are controlled by the Day Brothers. Such a tunnel would materially reduce the cost of shipments from all the mines as well as the cost of handling supplies, and at the same time allow an outlet for the ores right to the tracks of the Northern Pacific railroad.

MICHIGAN.

Isle Royale is gradually increasing its mining force, and now has 73 machine-drills in operation. About 45 of these machines are engaged in stoping in the No. 2 and 6 workings. Operations from the No. 4 and 5 shafts are confined to development work. The grade of ore in the new workings to the south averages about 25 lb. mineral per ton of rock, which compares with 18 to 20 lb. per ton from the older workings around the No. 2 shaft. At present there are two shafts equipped with permanent hoisting machinery, and a third, that at No. 4, will be similarly equipped within the next few weeks. The mill is working at about 50% of its capacity.——Operations at the Mohawk are confined to diamond-drilling, to determine the exact position and dip of the Kearsarge lode between the Mohawk No. 5 shaft and the Ahmeek No. 2. When this information is ascertained sinking can be begun, starting at a point about 800 ft. north of the Mohawk-Ahmeek boundary. The overburden at that point is 40 ft. deep.——The report of the Superior Copper Co. for the year ending April 30 shows that a profit of $35,000 has been made, instead of a loss as in the previous year. Shipments to the Atlantic mill were started in January, and showed 22.2 lb. copper per ton crushed. The No. 1 shaft has been widened for two skip-

ways and re-timbered from the surface to the fifth level. The openings have shown good copper ore in No. 1 shaft and drift. This shaft is now below the eleventh level and the cross-cut has reached the vein.

The directors of the Calumet & Hecla have declared a quarterly dividend of $6 per share. With the payment of this dividend stockholders will have received $103,950,000 in dividends since the formation of the company.——The Oneco Copper Co. is planning to diamond-drill its property in an effort to find the Baltic lode, which was recently disclosed by trenching upon the lands of the New Baltic Co., and presumably strikes across the greater part of the Oneco tract. The work will be in charge of the local management of the Hancock Consolidated Co. Operations are expected to begin this month.——Calumet & Hecla is engaged in sinking a shaft on the White Pine property in the Porcupine Mountain district of Ontonagon county. The White Pine is the property of the St. Mary's Mineral Land Co. and is held under option by the Calumet & Hecla company.

MONTANA.

SILVER BOW COUNTY.

The fire and gas in the Anaconda, Neversweat, and St. Lawrence mines, which had its origin in the St. Lawrence in 1889, seems to be spreading. The Anaconda mine had to be shut down entirely last week, and the gas interfered with operations in the two adjoining properties—the Neversweat and the St. Lawrence. Frequently gas breaks out in unexpected places and instantly fills up the underground workings, driving out the miners and making work impossible. For several months miners have been engaged in bulkheading the workings surrounding the fire zone in the Anaconda mine, and when the bulkheads are finished it is hoped the smoke and fire question will be solved for some time to come, but mining may have to be abandoned in a large portion of the Anaconda mine.——The Amalgamated Copper Co. has decided to sink a new shaft at the Gagnon mine, the property of the Trenton Mining & Development Co. It is intended eventually to abandon the old incline shaft. Several hundred feet have recently been added to the old shaft, which is now 2300 ft. deep, and the lower openings have proved so satisfactory that the Gagnon will again be converted into a producing property.

NEVADA.

ESMERALDA COUNTY.

A new find has been made about 55 miles southwest of Goldfield in Cottonwood canyon in the north end of Death valley. Samples carrying silver, lead, and gold have been brought in.——The Kansas City Velvet lease is making small shipments. A drift has been run on the 50-ft. level, cutting an 18-in. vein that assays about $6 per ton.——The McKinley-Hawkins lease at Rawhide has cut several veins of milling ore. Drifts are being started along the vein.

A new tube-mill has been ordered for the Florence mill. The mill is now treating from 145 to 150 tons daily, and this addition will increase the capacity about 30%. The cost of milling now is about $4.25.——A new 75-hp. hoist and large head-frame has been installed at the Grizzly Bear mine. The shaft is now down 500 ft., and is still in the Clermont vein, passing through it on the dip. A large body of quartz has been cut.——One thousand feet of new cable has just been placed on the hoisting plant at the Stoneham-Moore lease on the Combination No. 2, and sinking from the 500-ft. level started.

LINCOLN COUNTY.

A shipment of 20 tons was made from the Spokane lease, at Searchlight, to the smelter at the Needles.——The Lenape Gold & Copper Mining Co. has completed new office and residence buildings, and head-frames over both shafts, which are down 175 and 115 ft.——The Searchlight-Combination has cut a 6-in. vein at the 65-ft. level. E. H. Hitchcock is superintendent.

NYE COUNTY.

Manhattan is doing well in the development of the placers discovered, which are proving very rich. The gravel channel is an old wash, largely clay, on bedrock in the main gulch, much like the placers of the small gulches in Idaho and Montana, and evidently formed by a considerable stream.——M. A. Nurse and associates of Sacramento and Goldfield have closed a contract with the Nevada-California Power Co. for a daily electrical energy of 100 hp. The first dredge, which is of the suction type, will have a 6-in. pipe with air and water down to bedrock. The company controls a number of claims in and around the town.——The citizens of Manhattan have organized a vigilance committee to protect holders against claim jumpers, who have been active recently.——The Sunrise Co., operating on the Wilson claim of Wolftone Extension, is working three shifts of eight men and arranging for the installation of a complete placer plant. The channel has been opened for several feet, with values running from $8 to $15 per yard. Most of the gold is found near the northern rim.——The Chindren-Brown-Wilson lease is working a small body of gravel estimated to contain from $700 to $1000.——Cook & Kern have taken 300 ft. on the Black Cat and are arranging for extensive work.——Careful prospecting and testing of the placers at Manhattan and Central indicate that the average content is about $10 per yard. Practically all require considerable capital for their working, and the camp is not a poor man's paradise.——Quartz mining is again assuming prominence. ——Orders have been received from head-quarters to resume work at the Federal. The 200-ft. shaft will be carried to the 500-ft. level and comprehensive developments carried on. W. P. Wixon is superintendent.——The Irvine lease on Broncho creek has struck, at a depth of 6 ft., a 5-ft. vein assaying $100 per ton. The ore carries much flake gold. ——It is expected that the Tonopah Mining Co. will move its cyanide plant from Millers station to Tonopah, and thus cut off railroad transportation costs. A heavy flow of water at the 1300-ft. level of the Mizpah shaft assures plenty of water for milling operations.——A group of Eastern capitalists have secured the control of the Aurora Bullfrog Mining & Exploration Co., which owns 18 claims. The property is a large low-grade one, and the company contemplates the erection of a mill.

A new 300-hp. electric hoist has just been installed at the Mizpah shaft by the Tonopah Mining Co. and another compressor ordered. A cross-cut has been driven and a sump cut to catch the water coming down the shaft. A large station pump will be installed and the sinking below this point will be in dry ground.——The shaft of the MacNamara mine is down 770 ft. and a station has been cut. A few feet above the station the shaft cut a body of quartz lying on the contact between the dacite and underlying porphyry. On account of the vein lying very flat the station was cut about 20 ft. above the bottom of the shaft and a cross-cut commenced to tap the vein. This has been started, but has not yet encountered the quartz. A 5-ton shipment of sulphide ore was made from the Manhattan-Dexter. This will be tested by the Western Ore Purchasing Co.——The Solid Gold Mining & Leasing Co. has purchased the controlling interest in the Round Mountain Daisy Mining Co. This also includes the water-rights owned by the Daisy operators. The ground is adjoined on the east by the Fairview mine and on the west by the Antelope. A considerable amount of work has already been done and there are a number of orebodies of milling grade being developed.——The Fairview mill had its monthly clean-up a few days ago. This mill is treating 20 tons per day of ore which gives a gold return of $15 to $17 per ton. Only one shift is necessary in the mine to keep the mill supplied at its present capacity.

WHITE PINE COUNTY.

The April production of Nevada Consolidated and Cumberland-Ely was the highest in their history, and according to reports now at hand there will be still further increases at both mines during the current month. During the first week of May the output of the Nevada Consolidated averaged 58 cars, and the Cumberland-Ely 32 cars per day, or a total of 5000 tons daily. At the Nevada Consolidated overburden is being removed at the rate of 180,000 tons per month. Another steam-shovel has been ordered, with the

aid of which it is expected to remove 250,000 tons of overburden per month. During the month of April close to two million tons of ore were developed, and it is now stated that more than 30,000,000 tons of commercial ore is blocked out in the property.

OREGON.

BAKER COUNTY.

The South Pole mine at Sumpter has cross-cut an excellent body of ore. The ore is free-milling and the 5-stamp mill on the property will soon be started. Andrew Hansen is the owner.

JOSEPHINE COUNTY.

I. K. Evans, of Philadelphia, has purchased, on behalf of a syndicate, at a sheriff's sale all the holdings of the Galice Hydraulic Mining Co., St. Helen's Hydraulic Mining Co., the Galice Consolidated mines, and the T. K. Anderson properties. These corporations became involved in litigation over the right to use the waters of Galice creek. The Philadelphia syndicate will organize a corporation to be known as the Galice Placer Mines Co., and under this name the work of mining will be carried on.——Ore has been cut on the lowest level in the Alameda mine. This now exposes ore on four levels. E. R. Crouch is foreman.

WASHINGTON.

FERRY COUNTY.

The lessees of the Lone Pine claim, of the Pearl Consolidated group, are driving from the north end adit, to intercept the No. 4 Lone Pine vein, which yielded some ore of more than ordinary richness in the upper workings. Eleven men are employed. A 3-hp. gasoline engine has been installed, to run a fan for ventilation.——Two cars of ore were shipped from the Lucille Dreyfus mine, near Danville. In future one carload of ore per week will be shipped.——A large tonnage of ore has been blocked out in the Lone Star and Washington mines. The Canadian Pacific Railway Co. is building into Wellington camp, just across the international boundary line, in British Columbia, and will continue to a point opposite the Lone Star claim, from which an aerial tramway will be constructed to convey the ore to the railway, for shipment to the smelter.——D. Quincy Adams Mills, manager for the Little Pittsburg Mining Co., in the Republic district, reports he has found a body of gold and copper ore on the property in extending an old adit driven some years ago. The extent of the find is not known, as it has been cross-cut only three feet. The quartz shows a ribbon structure.

JEFFERSON COUNTY.

(Special Correspondence).—The Irondale Steel Co., at the head of which is James A. Moore, of Seattle, has a 100-ton blast-furnace at Irondale, 6 miles south of Port Townsend. The company is building two open-hearth steel furnaces and will install rolling mills. Henry S. Moulds, of Pittsburg, is connected with the Irondale project in a consulting capacity, and states that within six months from now the company expects to be producing 150 tons of steel daily. The company for two years has been developing iron mines on Vancouver island, near Quatsino bay, from which the necessary supply of iron ore is to come. This is a soft hematite ore and an immense tonnage of it is said to be accessible. It is proposed to obtain coke from Pierce county, this State, where mines of coking coal have been under development for some time.

STEVENS COUNTY.

D. C. Corbin is reported to have bonded the Wagner group of claims, situated on Hall creek, a tributary of Duncan river. The stamp-mill and concentrator on the Easter Sunday mine is completed.——Capt. L. Beecher has secured the right for the Hess cyanide process for Stevens and Ferry counties, and will erect a 5-ton experimental mill in Orient district, for the Border Mining & Milling Co., to treat ore from a number of claims taken over and bonded by the company.——A valuable strike of ore has been made in the Cuban mine, on Kettle river.——The adit on the North Star mine has 200 ft. farther to run before completion.——Ore of good grade is still being found in the shaft, in sinking on the Second Thought vein.——The First Thought mine has been shut down, presumably on account of the closing of the Greenwood smelter, and work may possibly not be resumed until the company builds a cyanide mill.——The shaft on the Kettle River mine, at Rockcut, is down 70 ft. and the bottom is in ore, carrying gold, silver, lead, and copper. A steam-hoist and pump has been installed. The shaft will be sunk to the 100-ft. level, where a station will be cut.——The Ark Group Mining Co. has broken into a body of gray copper ore, in a cross-cut being driven to reach the main vein, at a depth of about 200 feet.

CANADA.

BRITISH COLUMBIA.

An extensive plan of development work is outlined for the Westmount mine. F. E. Griffiths, manager and part owner, has just returned from eastern Canada, where he has conferred with associates in regard to the work, and development will be started immediately in No. 3 tunnel. ——It is said that work is to be resumed on the Mohican group controlled by the Poplar Creek Gold Mines Co. There is a good body of concentrating ore in the workings of this property, but only nine tons have been shipped to date, railway facilities being lacking. From the shipments made 60 oz. silver and 30% lead per ton was received.——The Majestic group of claims, at Sandon, has been bonded by G. H. Wright, of Vancouver, and a crew of 10 men will be put to work on the property at once. On the Morning Star group, Lardeau, ore has been cut that assays 2.2 oz. gold, 713 oz. silver, and 5.8% copper. The property is looking quite promising as work proceeds.

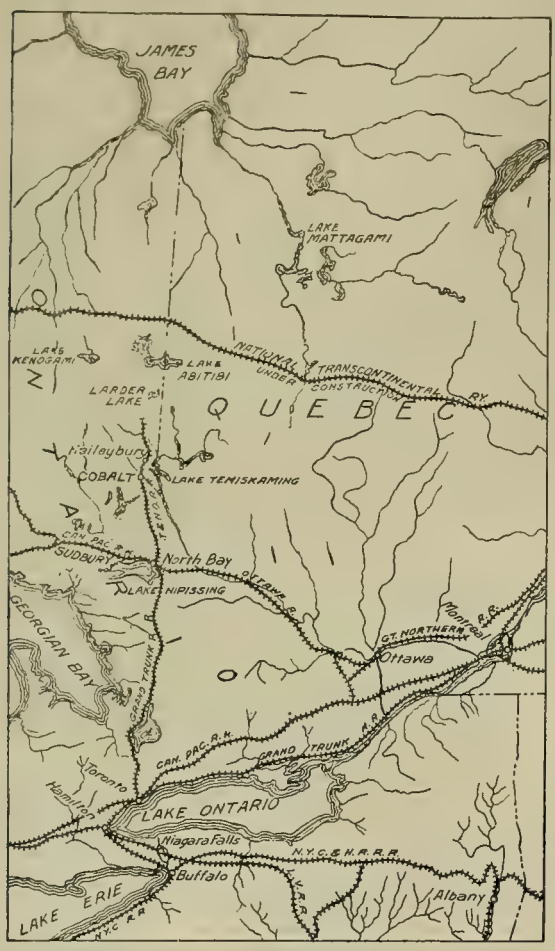
The Snowshoe mine at Phoenix continues to ship 10,000 tons of ore per month to the Trail smelter, where it is valuable as a flux. This ore is all being taken from above the adit, as the mine has not been unwatered below this level, and will not be until heavier shipments are necessary, as there is an ample tonnage of good ore for present requirements in the upper workings of the mine.——The British Columbia Copper Co. has 75,000 tons of ore ready to ship from the Jackpot mine, at Wellington, and about 200,000 tons ready for stoping from the No. 7 in Central, while the Lone Star is shipping steadily. With this spur line finished and shipping in progress the outlook for profitable operation at the Greenwood smelter of this company is favorable.——The Sally and the Golden Eagle mines both appear again on the shipping list for the week ending May 15, with 16 and 60 tons respectively.——The Greenwood tunnel has now advanced about 75 ft. and the work is progressing favorably. The operators are considering the installation of an 8-ft. Swiss-Chandler tunneling machine, which will drive the adit about 45 ft. per day. This will cost in the neighborhood of $60,000, but would prove economical even at that figure. This tunnel will open about 16 claims in the upper workings of which high-grade gold-silver ore has been found. In some of the claims a depth of 2400 ft. will be obtained.——A good body of ore has been opened on the Florence claim near Hedley. This property is situated so that it can be worked advantageously and will only require a moderate amount of capital to place it on a shipping basis.——The production of the Le Roi No. 2, at Rossland, is averaging nearly 500 tons per week of good ore which is going to the Northport smelter. A find of rich ore has been made on the 400-ft. level of this mine in a 30° diamond-drill hole. From 101 to 104 ft. the core assayed 0.12 oz. gold and 1.4% copper; from 118 to 119 ft. 9 in., and 6 in. at 121 ft. returned 1 oz. gold and 2.3% copper, while the sparsely mineralized portion of the core from 119 ft. 9 in. to 121 ft. ran 1 oz. gold and 1.4% copper.——A new shoot of ore has been opened up in the Centre Star mine that will average over $24 per ton. Considerable ore is being taken from the shoot on the fourth level of the Idaho and from the workings of the Iron Mask.

The owners of the Red Cliff copper-gold group on Portland Canal will expend about $25,000 in development work this summer and have already sent a small force of miners to the property. The main orebody is about 100 ft. wide,

and an average assay taken near the Montrose claim yielded $25 in gold, 3.3% copper, and 4 oz. silver per ton. There is a short tunnel in ore on the property, and this will be continued for some time to come.——The work which Herman Beckman has been doing on the Kimberley group of claims at Kamloops has disclosed a large body of low-grade ore. Most of the work on the group has consisted of open-cuts and stripping, and this has opened up a mineral zone about 1000 ft. wide by over 3000 ft. long. This ore will carry over 2% copper and $1.50 to $6 in gold, as well as a high percentage of iron. Lenticular bodies of ore of higher grade are cut in the course of the work. There is limestone on the property and as the ore can be quarried there is little doubt but that it could be treated profitably by a smelter at Kamloops.

ONTARIO.

The Crown Reserve is drifting on the 200-ft. level, the deepest on the property. The vein runs from 6 to 8 in. wide



Map Showing Position of Cobalt and New Districts in Ontario.

of high-grade ore. During April the Nipissing mined ore of an estimated net value of $149,739. Of the total 291,626 oz. of silver produced during the month, 108,680 oz., or 37%, came from the Kendall vein. The yield of the Kerr Lake during April was about 200,000 oz. silver, produced from 84 tons of ore. Most of this came from No. 7 workings, which include the recent discovery known as the McDonald vein. On this vein a winze has been sunk 32 ft. from the 150-ft. level, the ore extracted averaging 2000 oz. per ton. The pay-shoot on No. 7 has been traced for 600 ft. A new vein was recently struck about 4 ft. from the main vein on the Peterson Lake lease of the Little Nipissing. It is over 16 in. wide and carries 2 in. of cobalt. A new hoist and boiler are being installed on the company's J. B. 2 property, where drifting will be carried on at the 125-ft. level on a cobalt vein, with fair silver content. The Right of Way has declared a bonus of 10% payable May 20.——A 10-in. vein that assays as high as 3184 oz. silver has been cut in the Beaver Consolidated mine. The vein has been found only after persistent prospecting, as something over 3000 ft. of development has been run.——The Big Pete and King Edward mines both shipped a carload of high-grade and concentrate to the smelter.

MEXICO.

CHIHUAHUA.

The American Smelting & Refining Co. has decided to add at least two new furnaces to its Chihuahua smelter. The plans are said to be about completed. These furnaces are expected to be in commission by the end of the year. The local smelter now has three furnaces with places for two more. The present capacity is 450 tons daily, and two new furnaces will increase it to 750 tons per day. The local smelter is now taxed to its utmost capacity. The A. S. & R. Co. has one aerial tramway in Santa Eulalia and is about to begin another.

GUANAJUATO.

H. W. Benton, general manager for the American Mining & Milling Co., of the Corwin-Green interests, has just completed his annual report which has been submitted to the board of directors. The amount of development work accomplished at El Roble since November 3, 1908, is 303 metres, or approximately 1000 ft. This was in drifts, crosscuts, and raises. One of the raises connects the lower workings in the El Roble with the old Spanish workings. Considerable water has been encountered in No. 3 drift, which is being drilled to tap the extreme lower levels of the antigua workings.——The general manager of the Guanajuato Consolidated Mining & Milling Co. reports the return for the month of April 1909 as follows: The mill ran 28½ days and crushed 6984 tons of dry ore; concentrate shipped to smelter, 148 tons; estimated realizable value of bullion produced, ₱56,600; estimated value of concentrate, ₱46,600; total gross value in products, ₱103,200; less working expenses, including marketing of bullion and freight and treatment charges on concentrate shipped to smelter, ₱69,500; estimated profit, ₱33,700. Of this, ₱11,000 has been expended on development account. Amount of development work done, 406 feet.

SONORA.

The Greene-Cananea properties are producing copper at the rate of 50,000,000 lb. per year, and no effort will be made to increase this output at the present time. The copper content of the ore is now averaging between 45 and 50 lb. per ton. Remodeling the old plant is having a beneficial effect of the cost of operations, but this cost is still as high as 10c. per pound laid down in New York. The Capote mine, which was closed down for some time on account of a fire underground, is now contributing 10,000 tons of ore per month to the total output. By the first of June the company expects to put into commission its new compressor, which will supply air for all the mines, and effect a saving of $5000 per month as compared with present costs. A new central electric lighting plant is also nearing completion. ——Four carloads of new mining machinery have been shipped to the Zambona mines, at Minas Nuevas, where arrangements for its installation have been completed. The management of the Zambona Development Co. expects to have the new cyanide plant and other machinery installed and in operation within the next six months. A. J. Yaeger is general manager.——J. G. Alexander, who is now working the San Pedro mine under lease from the Moctezuma Copper Co., is starting a system of sub-leases. High-grade ore has been opened up in three places in the old working tunnel. In the Nacozari Consolidated Copper Co.'s main working tunnel on the La Galera claim, work is progressing satisfactorily, and the contact should be cut within 30 days. ——C. B. Dunster has been examining the Promontorio mine, below Moctezuma, for Michigan parties.——W. P. Belding of Los Angeles has taken over from George F. Woodward and associates of Moctezuma the Pura Plata mine, lying about 15 miles west of Moctezuma, on a $30,000 bond, and will start work immediately.

Special Correspondence.

LONDON.

Golden Horseshoe.—Sons of Gwalia.—The Greatest Gold Mine.

The Golden Horseshoe mine in West Australia is a remarkably regular producer, and promises to continue so for some time to come. The results for 1908 were almost identical with those of the previous year. The ore crushed was 247,740 long tons in 1908 and 247,020 in 1907. The corresponding figures for the production were 145,363 fine ounces and 147,680. Similar figures for working expenses were £292,098 and £294,220. Owing to rather greater expenditure on machinery, the dividend distributed in 1908 was £240,000, as compared with £255,000 in 1907. The similarity in figures extends to the ore reserves, which on December 31 were 1,065,409 long tons, averaging 11.88 dwt., as compared with 1,602,332 long tons averaging 12.24 a year before. The mine has now been producing for 11 years and has yielded 1,604,028 fine ounces and paid £2,760,000 in dividends. The new machinery referred to consists chiefly of electric plant driven by steam turbines and a 1000-hp. air-compressor. Additional Wilfley tables have been provided for the purpose of removing the pyrite from the slime. It is interesting to note that the whole of the cost of mine development and plant has been written off out of profits, the amount of the mine development being £290,958 and of plant £485,329, so that these two items do not appear in the balance sheet.

Another of the West Australian mines, the Sons of Gwalia, is not making such large profits as four or more years ago, but recent discoveries promise to increase the yield. During the year 1908, the ore crushed amounted to 156,267 short tons and the yield by amalgamation and cyaniding was 54,915 fine ounces, an extraction of 29s. 9d. per ton. The total costs at the mine were 20s. 4d., of which 8s. 7d. was for mining, 4s. 6d. for development, 5s. 10d. for treatment, and 1s. 6d. for general expenses. The amount realized by the sale of gold was £233,340, and the total expenses, including depreciation, taxes, and London office, approximately £175,000. Out of the profits £40,625 has been distributed as dividends. In 1904 and 1905 the distribution was £105,000 per year. The exploration work undertaken recently has brought to light two bodies of high-grade ore, and at other parts the mine-ore of the present average grade is opening up well. The ore reserves have been considerably increased lately and now stand at about three years' supply, so that the prospects of the mine have substantially improved.

During the last few months there has been some agitation in financial circles for a law requiring bankers to publish lists of dormant balances and companies to issue similar returns of unclaimed dividends. There can hardly be doubt that deaths and removals provide companies and bankers with substantial amounts of unclaimed funds which usually go into the reserve. This topic is not exactly one for general discussion in a mining paper, and I only mention it because some of the South African companies make it a practice to publish lists of outstanding checks for dividends that have not been presented. For instance, the Robinson Gold Mining Co. has just published a list of 49 checks still standing. It may be argued that if the shareholders or their representatives do not look out for their dividends they will be no more likely to see the published list. On the other hand, some other reader of the list may identify a name as that of a friend, and so be able to draw his attention to it. Anyhow the companies which pursue this policy are to be commended for the additional consideration for their shareholders.

The discussion which occasionally crops up as to which is the greatest of gold mines is always interesting. Not past, present, or future yields and profits determine the point, but a combination of all. For instance, compare the Waihi in New Zealand with the Robinson on the Rand. The South African engineer would have some justification for claiming that the Rand, being a continuous deposit, should be reckoned as one mine, worked in independent sections; but let that pass. The Robinson during 1908 produced 315,111 fine ounces, valued at £1,330,391, from 514,757 tons crushed, and £825,000 was distributed as dividend. Since the commencement of operations in 1888, the total ore milled has been 3,611,999 tons, the yield 2,873,300 fine ounces valued at £12,082,267, and the dividends £6,549,687. The ore reserves on December 31 last consisted of 1,970,926 tons of low-grade ore on the Main Reef averaging 4.75 dwt. per ton, and 2,788,362 tons averaging 11.3 dwt. in the Main Reef Leader and South Reef. Most of the ore now treated comes from the two latter sources, and provision is being made for dealing with the low-grade Main Reef ores by the erection of 40 new stamps, thus bringing the capacity up to 250 stamps. The working costs at the Robinson have been greatly reduced lately and stand at the remarkably low figure of 12s. 6d. per ton. This reduction has increased the profit in spite of falling contents, and has made it possible to treat the low-grade ores of the Main Reef. The life of the mine works out at about five years for the richer ores of the Main Reef Leader and the South Reef. It is too early to figure out exactly the life of the low-grade ores of the Main Reef.

Passing now to the Waihi, by way of comparison with the Robinson, since the commencement in 1890 to the end of 1908, the total ore crushed was 2,850,000 tons and the yield valued at £7,220,624, of which £3,325,386 has been distributed as dividends. During 1908 the ore crushed was 393,214 tons, and the realized yield in gold and silver £930,511. The contents are chiefly gold, the figures averaging 10 to 12 dwt. gold and 4 or 5 oz. silver. The dividend declared for 1908 absorbed £421,520. The ore reserves are given at 1,329,872 tons, and only include the ore that has been proved by drifts and cross-cuts. It is impossible to give an estimate of the life of the mine; all that can be said is that at many points there are large quantities of probable ore, and that exploration and development are continually adding to the reserves. So that though the Robinson is ahead as regards past and current history, the Waihi bids fair to win in the long run. The two mines have one point of similarity; that is, the managements are equally up to date.

SALT LAKE, UTAH.

Newhouse Mines.—International Smelter.—Iron Blossom Ore Trend.

E. P. Jennings has completed an inspection of the Newhouse properties in Beaver county. It is understood that he has been acting for bondholders. The impression is that his report will show a large tonnage of available ore. Samuel Newhouse says that work has been steadily carried on at the mine. The shaft, tunnels, and chutes have been retimbered, and considerable ore blocked out. On the second level alone, 25,000 tons running above 3% in copper has been found. The character of the ore is changing with depth, though the value remains the same. Work on the mill is progressing satisfactorily. The new equipment includes 16 Callow tanks, 12 Wilfley tables, 4 jigs for treating tailing, a new system of water carriers, screens, and the MacQuisten tables for treating middling.

E. P. Mathewson, general manager for the International Smelting Co., has just returned from the Northwest. He has with him an expert botanist and a veterinarian, who will study the conditions of vegetation and animal life in Pine canyon. Six months after the smelter has been in operation, these men will return to the valley and will compare the conditions. This step is taken to determine whether or not any injury is done to life and property by the operation of the plant. While the smelting company has an option on all land that can possibly be affected by fumes from the stacks, precautions are being taken to prevent any possible litigation. The first steel for the smelter will arrive June 7; the track to the Tooele site will be completed June 1. It is now planned to have the smelter running not later than April 1, 1910.

The Iron Blossom vein, at Tintic, trends 5° west of south, according to John Roundy, superintendent. Various statements have been given out by visiting engineers, to the effect that the high-grade orebody was trending east. Prop-

erty owners to the east have taken advantage of this to boost their property. Roundy's statement sets at rest all of these reports, as he is known as the 'ore-hound' of the Knight staff, having fathered three dividend-payers in the Tintic district.

WASHINGTON.

Tariff Changes. — Forest Reserve Lands. — Monument to Senator Stewart.—Coal Land Valuation.

Zinc producers from Joplin have been in Washington, prepared to fight for a tariff of one cent per pound on zinc in ores, but consideration of the matter has been postponed. After a spirited and acrimonious debate of four days the Senate fixed the lead schedule at 2⅛c. per pound for lead in pigs and bars, and 2½c. in sheets, pipe, and shot. Crude sulphur has been put on the free list, and a duty of $4 placed on refined. The Senate fixes the duty on iron ore at 25c. per ton after a lively debate which turned more on what would happen to Charles Schwab than anything else. Party lines are broken down, and Democrats in numbers are voting for higher tariffs, while numerous Republicans seem equally eager to reduce them.

In order to aid the Federal authorities in their efforts to reduce the number of fatalities in coal mines, F. M. Simmons of Raleigh, North Carolina, has introduced into the Senate an amendment to the tariff bill which provides that miners' rescue appliances and miners' safety lamps shall be admitted free of duty until January 1, 1912. The most efficient appliance, the oxygen helmet, is made in Germany. Rescue work in mines is so dangerous that it is not thought wise to take any chances with apparatus not up to the standard. Temporarily, at least, the helmets must be imported.

A bill has been introduced by F. E. Warren, Senator from Wyoming, providing that those who prior to March 3, 1905, in good faith conveyed title to the United States to land in any forest reservation shall be permitted to make selections of an equal quantity of the surveyed, unoccupied, and unappropriated non-mineral public lands, in lieu of the lands thus conveyed. George S. Nixon, of Reno, Nevada, Senator from Nevada, has introduced a joint resolution providing for the erection of a monument in Washington to the late William M. Stewart, for a number of years Senator from Nevada. The statue is to cost not more than $100,000.

The chief of the Denver Field Division of the General Land Office reports that 90% of the Colorado entrymen in areas supposed to contain coal will elect to take title to the surface, remitting to the United States the coal rights, as recent legislation permits. This indicates the value of this amendment of the coal-land act which was urged by Mr. Ballinger in 1907, when Commissioner of the General Land Office. If the entrymen, on the other hand, choose to contest, then the issue becomes one of relative worth between agricultural and coal values. In North Dakota, to which this act was supposed to be specially applicable, in all but 54 townships the land is found to be at present more valuable for agricultural purposes than for coal.

The regulations for the classification and valuation of the Government coal-lands, as revised in April, provide for fixing higher valuations upon lands underlaid by the higher grades of coal. The price of coal-land containing the lowest-grade bituminous coals or lignites is fixed at the minimum provided by law, the intention being to thus encourage immediate utilization of these low-grade fuels. The revised scheme differs from that formerly in force in two general respects. The basis is now specifically that of coal-tonnage, and the land-prices thus determined for the better grades of coal are higher. The plan of valuing the public coal lands by accurate determination of coal quality and tonnage is most equitable, and while adequate returns accrue to the Government, the land-prices thus fixed rarely amount to one-fourth of the royalties prevailing in the same districts.

The present scheme of valuation is as follows: Anthracite and coking bituminous coals are valued at 2 to 3c. per ton. High-grade non-coking bituminous coals are valued at 1 to 2c. per ton. High-grade sub-bituminous and low-grade bituminous coals are valued at ½ to 1c. per ton. Low-grade sub-bituminous coals and lignites are valued at a minimum price fixed by law of $10 and $20 per acre. In one township near Rock Springs, Wyoming, the valuation of which has just been completed by the Geological Survey, the coal-land values aggregate $2,800,000, on the basis of 1c. per ton. The amount for which the Government would have sold these lands on the basis of the minimum price allowed by law, under the interpretation which held prior to 1906, is $460,000, while under the valuation plan of last year the amount would have been a little less than $1,000,000.

GOLDFIELD, NEVADA.

Florence Goldfield Mill Extension. — Consolidated Development. — Copper Ore.—Combination Fraction.

T. G. Lockhart, president of the Florence Goldfield Co., has returned from Denver and announces that the capacity of the Florence mill is to be increased at once by the addition of a tube-mill and concentrating tables which will enable it to treat 200 tons daily. At present the plant is treating 120 to 130 tons, chiefly low-grade ore from the dumps of expired leases. Some ore of better quality is being taken from the company's workings, and from those of the Engineers lease and mixed with the low-grade, but the heads are still below $25 per ton. The raise from the 500-ft. level has advanced 50 ft. In support of their contention that the Florence company should not be compelled to pay bullion tax for the first quarter of the current year, the officials have filed a sworn statement in the office of the assessor, setting forth that they have operated at a net loss during that period of over $18,000. This came as a surprise, in view of previous announcements to the effect that operations were resulting in a production of from $50,000 to $100,000 monthly and affording ground for the inference that a resumption of dividend payments was contemplated. The mine is said to be in splendid condition, but the slime pond, already a heavy expense, is nearly filled after three months use of the mill.

The principal production of ore for the 600-ton mill of the Consolidated Mines Co. is being made from the Combination mine, where at the fourth and fifth levels the Hampton stope is opened to a width of 50 ft. Square sets are being installed. Between the fifth and sixth levels an intermediate cross-cut has entered the pay-shoot, and the uniformity of the ore has now been demonstrated by means of raises and winzes to the sixth level, 380 ft. below the surface. Other parts of the Combination mine are producing good mill ore, including the workings to the west, toward the January claim. Development has now begun from the Clermont shaft, in which stations have been completed at the 800, 900, and 1000-ft. levels. The further opening of the 260-ft. stope in the Lucky Boy claim of the Jumbo, a continuation of the Red Top drift, has developed a body of high-grade ore, but owing to the faulted condition of the vein its extent is still undetermined. In the southeast corner of the Mohawk and extending into the Jumbo claim, an orebody is being developed that is apparently second in volume only to the Hampton stope bonanza, though of lower grade. The stopes in this vein are now opened three abreast, each from 12 to 20 ft. wide, and the ore is opened from the 450 to the 600-ft. level. J. H. Mackenzie, manager, states that additions would probably be made to the new mill during the present year. Since that statement was made the reserves have been increased by a volume never anticipated, and it is probable that the plant will be enlarged, by the addition of stamps, to at least an 800-ton daily capacity.

In sinking the sump below the 400-ft. station of the Victor shaft of the C. O. D. Consolidated the same vein has been cut from which high-grade ore was mined at the 200 and 300-ft. levels. It was from this vein that the first copper ore in the district was taken, the ore running high in gold as well as copper. Below the 400-ft. level the vein carries a fair percentage of copper, but the assays show little gold, and apparently the pay-shoot must be sought by driving on the lead. Production at the 300-ft. level was suspended until the shaft should reach the 400-ft. station, but will now

be resumed from both the 200 and 300-ft. drifts. Nearly 700 ft. southeast of the Consolidated company's Clermont shaft the Grizzly Bear Mining Co. has penetrated the Clermont vein, passing through the lode on its dip for 40 ft. Quartz, but no ore of commercial value, was found in the shaft. Drifts will be driven both ways while the shaft is continued to 800 ft. At the 600-ft. level of the Combination Fraction a cross-cut is being run to the northwest in the effort to cut the Hampton stope vein of the Combination, which is thought to dip into Fraction ground at about that depth. The Fraction is producing 80 tons daily of $37 ore, the product coming chiefly from stopes between depths of 250 and 400 ft. The Little Florence lease on the Fraction is not producing, but has developed a good tonnage of medium-grade mill ore. On the Combination No. 2 the Stoneham-Moore-Griffiths lease is taking out small quantities of rich ore from a narrow vein in a raise from the 500-ft. level and will continue sinking the shaft an additional 200 or 300 ft. The Daisy mine continues daily shipments of $100 ore, and is developing at the 500-ft. level. The Great Western mine, at Hornsilver, for some time past a producer of silver-lead ore, has been closed down owing to the high cost of production and transportation, amounting to $35 per ton on its $40 product.

DENVER, COLORADO.

San Juan District.— Cripple Creek. — The Golden Smelter and Clear Creek Mining.—Wyoming Coal Land Fraud.

The shipments from the San Juan district show a marked increase for the month of April, the total being 3450 tons of concentrate and 25 tons of crude ore. The Gold King was the heaviest shipper, sending out more ore than any other two mines. This mine is closed down temporarily by the fire which destroyed its surface plant on May 18. The buildings were burned a year ago on almost the same date. Sparks from a passing engine are believed to have been the cause. The Esmeralda Mining Co., owning the Esmeralda mine, in Mining gulch, 7 miles northeast of Silverton, is making arrangements to install a large cyanide plant. S. S. Watson, representing the New York owners, is directing the work. The Ouray Mine Operators Association has appointed a committee to investigate the Fink furnace.

The Cripple Creek drainage tunnel continues to figure prominently in the affairs of that camp. Thirty thousand of the $160,000 necessary to complete the tunnel has been pledged, most of it, however, contingent on the subscription by the Colorado Springs Mining Exchange of $5000. Probably the most serious accident to date in the drainage tunnel occurred in the north heading from the intermediate shaft, on May 17, when a missed hole was drilled into. One miner was killed and six others injured by the resulting explosion. The Gold Doller Mining Co. is being sued for trespass and for wrongful extraction of ore by the owners of the Gold Bug claim. The claimants ask $150,000 for bullion extracted, and $25,000 damages because the Gold Bug claim has been covered in part by the dump of the Last Dollar. The Doctor Jack Pot Mining Co. has declared a dividend of ½ cent per share, payable on June 1. The dividend amounts to $14,000, and is the first for some time. A. E. Carlton has been elected president of the company. An 18-month lease, with royalties graded from 15% upward, has been secured by Haas & Meyers on the Maria A., on Raven hill. The lessees have begun to retimber the shaft.

Clear Creek miners are rejoicing over the fact that the Carpenter smelter, at Golden, is to be operated again. This plant was designed to handle the low-grade ores from this district, and was very successful until forced to close by lack of ore. This smelter is to be operated by the North American Smelter & Mines Co., of which H. A. Riedel of the Riedel Investment Co. is general manager. This company controls the Donaldson mine, the Centurion Mining Co., and the Banner Consolidated Mining Co. From these a steady supply of ore is believed to be assured. Certificate of incorporation of the Adudell Mines Co. has been filed with the County Clerk. The capitalization is for $1,000,000. The company is already operating the Adudell mine, in Russell gulch, and is shipping by tram to the Iron City mill, at Black Hawk. The mill is under lease to the company.

The Owl Creek Coal Co., operating in the vicinity of Gebo, Big Horn county, Wyoming, has got into trouble with the Federal Government. The charges involve the acquisition of coal lands through the use of dummy entrymen. The summoning of 47 persons, living in New York, as witnesses was the first intimation that the Government had been making careful investigation of the alleged land frauds.

NELSON, BRITISH COLUMBIA.

Silver King.—Eureka. — Granite-Poorman. — Queen Victoria. — La Plata.—Hall Smelter.

The mines being operated in the vicinity of Nelson are the Silver King, Eureka, Granite-Poorman, Queen Victoria, and several small properties. The Granite-Poorman is a gold mine; the main product of commercial value of the others above named is copper. The La Plata, formerly known as the Molly Gibson, is a silver-lead-zinc property, situated on Kokanee creek, northeast of Nelson and on the opposite side of the west arm of Kootenay lake. The Silver King mine, shipments from which were lately resumed, was the first lode mine worked in Nelson district. It is situated on Toad mountain, a few miles south of the town. Mineral was accidentally discovered in 1886 on one of the claims now constituting the group. The property was sold in 1893 to an English company incorporated as the Hall Mines, Ltd., and reorganized in 1900 as the Hall Mining & Smelting Co., Ltd. The mine was equipped with machinery and for years was productive, yielding ore carrying considerable silver and copper. Later it was worked under lease by M. S. Davys, and then was idle until the current year, when, after the Hall M. & S. Co. had been compelled by financial difficulties to entirely suspend operations, Mr. Davys organized in London, England, the Kootenay Development Syndicate, Ltd., which acquired the property under lease and option of purchase. A local board of management was appointed, and one of its members, Louis Pratt, now of Nelson and well known for years as manager of a Slocan district silver-lead mine, was placed in charge of operations. The aerial tramway from the mine to the smelter at Nelson was put in working order, electric power was substituted for steam at the mine, the workings were pumped out down to the seventh level, and shipment of ore was resumed. During April nearly 1500 tons were sent to the Consolidated M. & S. Co.'s smelter at Trail. The average grade of ore is understood to be similar to that obtained during earlier operations. In 1904, 4340 tons of ore mined averaged 21.4 oz. silver per ton and 3.66% copper. Under the old regime the mine was opened to 1000 ft. depth. It is not intended to unwater the lowest levels for a time.

For a time development of the Eureka was by means of a shaft and openings, but last year driving a cross-cut was undertaken and about 500 ft. driven. This year the extension of this working to about 750 ft. from the adit portal, and raising therefrom to connect with the shaft, is in progress. No ore has been shipped since 1907; production in that year was 620 tons of ore, averaging gold 0.21 oz. and silver 2.5 oz. per ton, and copper 5.5%. The property is owned by the Eureka Copper Mines, Ltd., of which company L. B. Reynolds of Nelson is managing director. The Granite-Poorman mines, owned by an English company named the Duncan United Mines, Ltd., and for some time successfully operated by it, are under lease and option of purchase to Thos. Gough, J. P. Swedborg, and E. E. Guille, who have mined and milled about 6000 tons of ore during each of two years just past. Last year approximately 1900 oz. gold and 290 oz. silver were recovered from 6160 tons of ore. Underground development is being continued, while a number of ground-sluice ditches have uncovered some promising lodes. Recent surface improvements include renewal of battery blocks under the mortars of a 10-stamp mill and erection of ore-bins and pockets. The Queen Victoria is now under bond to the Consolidated Mining & Smelting Co. of Canada, Ltd., which is further prospecting the big orebody occurring on it. The property it situated about seven miles

from Nelson and a short distance from the Canadian Pacific railway. For a time it was worked under bond by James Cronin of Spokane, Washington, and associates, who shipped to the smelter at Trail about 3500 tons of ore averaging 2.6% copper and only a little silver and gold. When the price of copper fell considerably, this bond was thrown up. During 1908 New York capitalists were interested in it, and J. Parke Channing had a representative on the ground. A 6-drill air-compressor, electrically driven, was installed to expedite prospecting operations. Early this year these operations were discontinued, and though no reason was assigned, it was understood that the ore was not high enough in grade to induce purchase of the property when the price of copper was low. Before ore was shipped the orebody was described by a well known engineer as being "a bluff of copper ore standing out in bold relief from the country rock, measuring along the face, that is, the strike of the deposit, more than 400 ft. in length. Across the deposit horizontally the width is 300 ft., and the ore shows vertically for 150 ft. with a westerly dip." Among others who have examined the property is Walter Harvey Weed, who visited it early in 1908.

Other properties about Nelson which have been productive to a considerable extent in past years are the Fern and Athabasca-Venus, both having stamp-mills; also the May and Jennie, first worked by A. H. Kelly, and afterward by



Hall Smelter at Nelson, B. C.

the Reliance Gold M. & M. Co., which installed a Blake crusher and rolls, 6-ft. Akron Chilean mill, and cyanide plant with a 12-ft. Hendryx agitator. Much experimental work was done, but of late mine and mill have been idle. The La Plata was operated for a time with an average of about 50 men in mine and mill, but lately it has not been worked. The vein is in a granite formation and has been opened by four working levels and a prospecting drift. The ore is quartz, with siderite, argentiferous galena, and blende. No. 5 tunnel is at an altitude of about 6600 ft., which is 2200 ft. above the mill, and there is an Otto aerial tramway 8450 ft. long between the two. The mill equipment is complete. The product was 5 tons of first and 10 tons of second-grade concentrate, and 2 tons of hand-sorted ore, from 80 tons delivered daily by the tram. Mill-feed averaged 4 to 5% lead and 20 to 26 oz. silver per ton; concentrate and picked ore contained approximately 10% zinc. The product was hauled 12 miles by wagon to Kootenay lake, and taken thence by steamer or barge to Nelson, where it was loaded on cars for transfer to the smelter.

The Hall M. & M. Co.'s smelter at Nelson has not been operated since the suspension of the company. It was established to treat Silver King copper-silver ores, but later the furnaces were altered to adapt them to lead smelting.

It looks as though the affairs of the Sullivan Group Mining Co. would now be adjusted without participation of the shareholders. The attempt to resuscitate the old company having failed, it is now planned to reorganize, issuing first preferred stock, bearing 7% annual dividend, to cover the amount of the bonded indebtedness, with interest, over $400,000. Second preferred stock, bearing same dividend rate, will be issued to cover the other liabilities of the company, something over $60,000. This stock will be subject to recall by the company, at par. Common stock will also be issued to the amount of the first preferred stock, and will be divided among the bondholders, who will be assessed for the cost of reorganization. This will adjust things as far as the bondholders and creditors are concerned, but is hard on the stockholders. It is pleaded, however, that only about two-thirds of the stockholders were willing to come into the plan first proposed, which embodied an assessment. The company has a promising mine, in which there is a large quantity of ore ready for stoping.

BUTTE, MONTANA.

Churchill Separator.—Alex Scott Mine.—Zinc Works.

An experimental mill has been constructed on the site of the old Yankee Boy mill by the Churchill Co. of Boston to try a new separator. Creighton Churchill, vice-president and general manager of the company, is the inventor, and is in charge of the work here. The mill is of a 24-ton capacity. The system involves reducing the ore by crushers and rollers to a maximum of ¼ in., and by means of trommels, revolving screens, delivering the ore to 3 Churchill separators. No. 1 machine takes ore of sizes between 6 and 3 mm.; No. 2 machine takes that between 3 mm. and 1½ mm.; and No. 3 takes the entire undersize through a 1½ mm. screen. The tailing discharged from machine No. 3 is sent to 2 Wilfley tables without classification. With the mill arranged as described, a test run of 48 tons of ore containing 16½% of iron and 1½% of copper resulted in obtaining 16½ tons of concentrate running 41% iron and 3% copper; and this was obtained without the use of jigs. About one-half of this concentrate produced came from the tables, and the remainder from the Churchill machines. This run was made to get as high concentration of iron as possible, on the supposition that the copper, being of a high specific gravity, would to a certain extent take care of itself. The approximate result of the run was an extraction of 89% of the iron and 67% of the copper, the low extraction of the copper being largely due to the amount of slime produced by crushing all the ore to a quarter-inch size. Another run on zinc ore, although the ore was not carefully sampled, gave results which led to the introduction of a machine in the Butte Reduction Works, where it will be tested under practical conditions.

The machine is being tested in Butte because Butte ores are probably as hard to treat as any copper ores known. By reducing the ore to ¼-in. as a maximum size to start with, the sliming tendencies are given full play, whereas, if the mineral had been taken out at the maximum size of 2 in., considerable re-crushing would have been avoided and consequent loss due to sliming been eliminated. The 3 machines are installed on the second floor, and occupy floor space of 2 by 7 ft., the head-room being about 3 ft. The entire installation, excluding the space occupied by the two Wilfley tables, is 20 by 24 ft. In appearance the machines resemble cone classifiers, having an over-all diameter at the top of 24 in., and being 33 in. high. The theory of the Churchill separator is that of the separation of the valuable from the non-valuable portion of the ore by means of a rising current of water, combined with centrifugal force. Detailed description of the device is withheld for the present.

The Alex Scott Mining Co., which is successor to and a reorganization of the Butte-Montana Co., has received a new Nordberg hoisting engine, which will be installed shortly. The present work in the Alex Scott is confined mostly to opening orebodies and developing the vein on the 1000 and the 1200-ft. levels. On both the company is driving on the vein east and west. Some good ore is being taken out in the course of development. On the dump there are now more than 500 tons which it is claimed will average 6% in copper.

The new zinc concentrator installed at the Butte Reduction Works is working satisfactorily. There are a number of properties to the north and east of the city which it has been impossible to work at a profit because of the presence

of zinc. Last year a Boston corporation owning and operating zinc plants in Plattesville, Wis., Salt Lake City, and at various other places, sent an expert to Butte to investigate the possibilities of operating a zinc plant at Butte. After several months the expert was withdrawn. It is understood that the reason the field was abandoned was that the available amount of zinc ores was not sufficient to justify the investiment of the $75,000 to $100,000 necessary.

MEXICO.

Mexican Northwestern.—Velardena. — Torreon. — Orient Railroad. —El Oro Camp. — Chihuahua Smelter. — Candelaria. — Hinds Consolidated.—San Luis, Durango.

The plans of the Mexican Northwestern Railway Co., of Canada, are much more comprehensive than was at first supposed. F. S. Pearson's engineers have been over the line of the proposed railroad from Monclova, Coahuila, to Chihuahua, and it is believed that the concessions for this will be taken over and the road built to connect with its Chihuahua & Pacific and the Sierra Madre & Pacific railroads, which now form a continuous line from Chihuahua to Madera. The Pearsons also have a concession for the continuation from Madera north to Terrazas, the southern terminus of the Rio Grande, Sierra Madre & Pacific, running out of Ciudad Juarez. Attempts have been made to acquire this road also, but as yet they have not been successful. A concession has been obtained, therefore, for paralleling the Rio Grande, Sierra Madre & Pacific, so as to enable the Mexico Northwestern to get into El Paso. From Guzman, on the Rio Grande, Sierra Madre & Pacific, a line is being surveyed to Douglas, Arizona, and on to Cananea, Sonora. These lines of railroad, with the Sierra Madre Land & Lumber Co. holdings (also acquired by the Mexico Northwestern) would give Pearson and his associates practical control of the Mexican coal and lumber business in Sonora and the adjacent section of the west coast.

In the State of Durango, outside of Velardeña, matters appear to be comparatively quiet. At Topia there is some active work, and operations have been resumed on the San Fernando by J. P. Canfield, who is cyaniding the ore and shipping out the bullion. At Inde the Inde Reduction Co. has taken over the Madrigal group, which yields a lead-copper ore, with some silver and gold. At Velardeña there is unusual activity. The mines and smelter of the American Smelters Securities Co. are being operated at full capacity. At the smelter, for some time after blowing in, many metallurgical difficulties were encountered, but these have now been overcome and excellent results are being obtained. This plant was built originally for treating copper ore, but is now principally a lead smelter, the change having been made necessary to correspond to a change in the ore. The mines now give a lead production greatly in excess of copper. The erection of a copper converter stand at the Torreon plant is proceeding. It is not probable that the completion and blowing in of the converter will be rushed, for Torreon's receipts of copper ore can not now be sufficient to keep a converter continually in blast, and it would certainly be cheaper to continue to sell matte to the Aguascalientes plant of the American Smelting & Refining Company.

Arthur E. Stilwell, president, and Edward Dickinson, vice-president and general manager, of the Kansas City, Mexico & Orient Railway Co., were in Boston recently. There is a Boston investment of about $800,000 in this property. Mr. Stilwell says: "We have gone through a hard two years, but have been able to continue our building operations. Last year we built 135 miles of new road and, other than the St. Paul, I know of no railroad in the United States which did better than this. We have a total of 859 miles of railroad built and in operation, out of a prospective total of 1659 miles when we have built through from Kansas City to the Pacific. We have already raised a total of $20,000,000, and it will take $15,000,000 more to complete the road. We hope to have it completed within two years. The road we now have in operation is more than paying operating expenses. In Mexico about 65% of our line is in operation, and we have already gone over the continental divide with a grade of about 2½%, though it has been stated that we could not get over the divide unless we had engines with teeth or wings. We have been successful in London in raising money. We expect in the not distant future to have a public issue of $3,000,000 bonds in Paris and $5,000,000 in London."

In the State of Mexico, camp of El Oro, the Dos Estrellas continues with a production of about 30,000 tons of ore per month and a net profit of ₱400,000; the Victoria y Anexas is driving both east and west cross-cuts at the rate of 5 metres per week, but as yet there is no change, while in the cross-cuts at the Descubridora small stringers are showing. In the Esperanzas the rich quartz sulphide vein has been opened on the ninth level, greatly to the encouragement of the management and the company.

It is stated that the American Smelting & Refining Co. has approved the plans for the additions to the present Chihuahua plant. These will consist of additions to the power-plant and of two new stacks in the furnace building, giving a total of five stacks, with a smelting capacity of 750 tons of lead ores per day. This will allow of an appreciable increase in the company's Santa Eulalia shipments above what is being sent to the El Paso plant. The introduction of electric motors and hoists where steam is now used will effect a much more economical handling of material. The changes may be completed by the end of the current year.

At San Pedro, on the Rio Grande, Sierra Madre & Pacific railroad, the Candelaria Mining Co., whose properties have been practically closed for several years, have been able to unwater the old workings and resume operations. The shipments at present amount to 20 cars per week to the El Paso smelting works, and from 8 to 10 cars per day will be shipped by the end of July. The statement just made by the Rio Plata Mining Co. shows its property to be a notable one. Final payment of ₱50,000 for the mine, on the total of ₱730,000, was made on May 4, and since the Santa Barbara mine, in the Guazapares district, was taken over, two years ago this month, the product of the mine has paid for all running expenses, for the erection of a 25-stamp mill, and for the entire purchase price of the mine, with the exception of the ₱50,000 above mentioned. The ₱50,000, the 275-hp. hydro-electric power plant, and the 100-ton cyanide addition to the mill have been paid for out of the sale of stock. There are 20,000 tons of ₱40 ore on the dump awaiting treatment. The report of the Batopilas Mining Co., in western Chihuahua, gives as the output for the last fiscal year 931 bars of silver bullion, or 839,865 fine ounces of silver, an increase of 8328 oz. over the output in the previous year, but the drop in the price of silver was such that the profits amounted to only $57,445, a decrease of $28,221 from those of the previous year. As a consequence, no dividends were declared, the profits going into the surplus fund. For the Palmarejo & Mexican Gold Fields, Ltd., where in twenty years ₱5,000,000 has been spent, E. T. McCarthy has recommended the expenditure of another ₱400,000. It is the purpose of the company to increase its capital stock by £175,000. Thus it will be possible to block out sufficient ore to keep a 250-ton mill supplied for two years. In the Parral district the Hinds Consolidated M. Co. is successfully operating its small mill and is producing a carload of concentrate per week. Plans are now being drawn, based upon the results of the small mill, for the erection of a 500-ton mill, in two units of 250 tons each. At the Tecolotes mill of the American Smelters Securities Co., by direct re-crushing, classification, and fine concentration, 800 tons per day of ore is being treated, and the mill is running over 89% of full time. Some 40,000 tons of zinc middling has accumulated, awaiting the installation of a magnetic separator, for which it is said appropriations have now been made. W. E. Simpson, formerly of Kalgoorlie, Australia, has recommended the Broken Hill methods for handling the complex sulphide ores at the San Francisco del Oro, at Parral.

The San Luis Mining Co., controlled by the Haggin-Hearst interests, is about to install 18 Merrill single-stamp, 1000-lb. batteries, with an appropriate complement of tube-mills, at its mines near Socavón, Distrito de San Dimas, Durango.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

A cord (128 cu. ft.) of 4-ft. hardwood usually contains about 83 cu. ft. of solid wood; a cord of 3-ft. wood averages 83½ cu. ft.; of 2-ft. wood, 84 ft., and of 1-ft. wood, 85 ft. The conifers, softwoods, contain 90 to 96 cubic feet.

Scale in boilers may sometimes be prevented by the use of glycerine. This acts by increasing the solubility of the calcium and magnesium salts, and when the limit of solubility is reached, causes them to separate in a gelatinous form which remains in suspension.

Amblygonite, the phosphate of lithium, has been found in commercial quantities only near Pala, San Diego county, California. It contains a higher percentage of the metal than lepidolite and spodumene, the silicates, but being less abundant is not so important as an ore.

Asbestos is finding a new field as a result of improved construction of electric railways. The need of an insulating material less brittle than glass and porcelain and more durable than rubber, has led to the adoption of new compositions which, with asbestos as the base, possess both tensile strength and heat-resisting properties.

Manjak is a local name applied to the glance pitch which occurs commercially upon the island of Barbados. Manjak is a variety of asphaltum which resembles gilsonite in appearance but is more brittle and friable. It is a pure hydro-carbon, and is used in the manufacture of high-grade water-proofing, varnishes, and insulating compounds.

Zinc is often used to prevent corrosion of boilers. Its efficiency is due to the fact that any metal with a greater tendency than iron to dissolve, on which hydrogen is liberated with more difficulty than on iron, will protect the latter at the expense of the more soluble metal. The protection, however, becomes ineffective in pure water at a distance greater than about an inch. Salt or some other electrolyte will extend the zone to 20 inches or more.

A mining claim which by location monuments proves to be longer than 1500 ft. may be reduced in an amended location notice, cutting off the excess at either end. In a case referred to us, the assessment work was done so close to one end of the claim as originally located, that curtailment applied to that end would leave the development workings outside the rectified boundaries. Manifestly the lopping off would be done at the opposite end in such a case.

Flint pebbles come mainly from the coast of Greenland and on the beaches between Havre and St. Valery-sur-Somme in France. It is estimated that the French deposits cover a distance of over a hundred miles, and yield annually for export, principally to the United States, Australia, and the Transvaal, from 13,500 to 14,000 metric tons. These pebbles are a calcedonic variety of silica occurring in the Cretaceous chalk. They are irregular in shape and size, and extremely hard. The introduction of the tube-mill has led to a rapid demand for them. In America, black flint pebbles occur along the Colorado river in Texas, in Florida, California, Kansas, and in other States.

Cementation index is a term applied to the hydraulic activity of various cementing materials. Its value for any limestone or cement may be found by applying the formula:

$$\text{Index} = \frac{\text{CaO}\% + 1.4\text{MgO}\%}{2.8\%\ \text{SiO}_2 + 1.1\%\ \text{Al}_2\text{O}_3 + 0.7\%\ \text{Fe}_2\text{O}_3}$$

The index of natural cements varies from 1 to 2, but usually falls between 1 and 1.15. For portland cements 1 is the ideal index.

Phosphate rock is a general term for several forms of amorphous material containing more or less phosphate of lime. Variable quantities of carbonate of lime, of silica, and other substances are present. Numerous grades of rock, such as hard rock, soft rock, land pebble, brown rock, white rock, etc., are recognized in the trade. These terms have important but local meanings, and are not uniformly applied, even in individual producing regions.

Mica is widely distributed, but usually in flakes and crystals too small to be of value. Both biotite and muscovite occur in igneous and metamorphic rocks, as well as in sediments derived from them. Phlogopite appears to be confined to metamorphic rocks, and generally with relations indicating its igneous origin. Muscovite is the mica mined in the United States and India, while phlogopite is obtained in Canada. The mica mined near Custer, S. D., is found in pegmatite.

The nominal horse-power required to thaw 3000 cu. yd. of gravel per day can be estimated. The figures are based on the assumption that one ton of coal will raise the temperature of 200 yards of gravel 50°, that 0.3 lb. of coal is burned per square foot of heating surface, and that 12 sq. ft. of heating surface equals 7 hp.; then:

Nominal boiler horse-power	=	350
Tons coal per day	=	15
Cords wood per day	=	30

Sulphur and sulphuric acid in the United States are derived from native sulphur, from iron pyrite mined specially for use as a source of sulphuric acid, and from sulphides carrying workable percentages of copper, lead, zinc, or other metals of value. In the last-mentioned case the acid is a by-product. Abundant fumes for making acid are available from the last source, but owing in part to the common presence of harmful impurities, and in part to the usually necessary position of smelters away from centres of manufacture, relatively little is utilized. Since commercial acid contains large quantities of hydrogen and oxygen, obtained from the air and from water, it is cheaper to ship sulphur to the place where the acid is to be used than to ship the acid itself.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Weight of Stamps.

The Editor:

Sir—The most economical weight of stamps has been much discussed, and the practice in various parts of the world, under conditions of reasonable cost of iron, steel, easy transportation, and an abundant mining capital under superintendence of competent engineers, shows a variation ranging ordinarily from 750 to 1600 lb. in common use. Stamps weighing 1750 lb. have been used experimentally with favorable results on the ores of the Transvaal. In these goldfields heavy stamps are general. Increased weight of stamps has unquestionably been brought about by reason of the character of material delivered to the mills. The ores supplying these mills during the earlier period of activity had been softened by oxidation and were easily crushed. Stamps of a light weight, varying from 900 to 1000 lb., with screens of 22 to 24 wires per inch, gave a duty of 5 tons per stamp per day.

In the deep levels, now well below the oxidized zone, the matrix of the reefs as well as the enclosing quartzites, produce an exceedingly tough and hard material. The quartzite country rock becomes mixed with the reef material in working out the arbitrary stoping widths there customary. This quartzite is intensely firm and without lines of cleavage. The pebbles embedded in the reefs are themselves more resistant to the stamps than the quartz which surrounds them. The weight of the stamp is therefore adapted to the material to be crushed.

The high stamp-duty lately obtained in these fields with newly erected machinery equals at some mills 9 tons per day. It has been largely made possible by improved stone-crushing plants. In these the rock is first passed through breakers of the Blake pattern, and then through gyratory crushers, such as the Gates, and brought to a size not greater than 1 in. maximum diameter. At the same time the introduction of tube-mills has permitted the use of coarser screens at the batteries.

The weight of a stamp must conform within certain limits to the hardness and toughness of the material to be crushed, so that the resistance of the rock beneath the stamp shall be great enough to prevent the shoe and die from unnecessary fracture, and at the same time obtain satisfactory discharge of the crushed material through the screen. It remains to be proved that the standard of heavy stamps now used on the Rand could be successfully applied to the friable quartz material such as usually occurs in the porphyritic formations in the United States.

In the great improvement in ore treatment at present going on in the Witwatersrand district, it is now, and must remain for all time, a question of management, at what point the pulverization of ore shall cease in the battery and be taken up and continued in the tube-mill. The greatest of all controlling factors at each separate plant is the percentage of low-grade battery-crushed material allowed to pass through the spitzlutzen or other separating device direct to the percolating tanks that is too low in value for tube-mill grinding. This must be considered when cost of the pulverization is taken into account and in looking forward to an all-slime treatment in any part of the world.

MARTIN JONES.

San Francisco, May 21.

Re-Setting Tappets.

The Editor:

Sir—An article published in the MINING AND SCIENTIFIC PRESS on January 30, by Thomas N. Miller, suggests that consideration of methods of re-setting tappets may be of interest. Mr. Miller states that a first-class millman will set a tappet on one stem while the remaining four are running, thus continuing the crushing without loss of time. In discussing this point, Robert H. Richards, in his work on 'Ore Dressing' agrees with Mr. Miller, with one exception. He cites the practice at the Utica mill, Calaveras county, California, "where the periodic shifting of tappets to allow for wear of shoes and dies is usually done without hanging up more than one stamp at a time, except that when a feed-stem is adjusted, all the others must of course be hung up. When the batteryman is ready to set tappets, he allows the battery to 'pound out' so that the stamps hit the dies. He then measures the drop with a stick, and notes it mentally. Next he hangs up the stamp and loosens the keys so that the tappet can be moved the desired amount by striking it from below. The keys are then tightened, and he goes on to the next stamp."

Additional suggestions that I make tentatively are the following: should one or two tappets only in a battery require immediate re-setting, the alteration needed to approximate the correct drop may be estimated offhand, and the tappet re-set. Later, as occasion offers, or when necessary, the drop of each stamp should be measured in the mortar and the corrected position of the tappet marked on the stem above the tappet, which may now be re-set at will.

As given in the quotation from Richards' 'Ore Dressing', common practice in the main consists of hanging up the stamp, loosening the tappet-keys, and raising the tappet by striking the upper flange from below. Raising the tappet, however, by striking it from below with a hammer often proves a tedious and laborious undertaking, and prompts the following more effective procedure. Hang up the stamp; loosen the keys sufficiently to allow the cam to drive the tappet; drop the stamp, and catch it again on the finger just before the tappet passes the mark on the stem, when it may be nicely placed on the line with the hammer, and the keys again seated.

To increase the drop, the driving-power of the cam will be found equally serviceable, especially in the case of a tight tappet. After having loosened the keys, drive the tappet upward by means of the cam, at least to start it, and if necessary clean the stem; then raise the stamp and lower tappet to line.

Battery-men alone will appreciate the time and

labor saved by using the cam instead of a hammer for starting and placing tight tappets. Moreover, when decreasing the drop, its use disposes of Mr. Richards' one exception, as the feed-stem is readily set without hanging up the other four; and it becomes unnecessary to allow the battery to 'pound out'. In reality, a stamp may be dropping three-fourths of the time required for setting its tappet, and at the same time be crushing ore. To work to the best advantage in setting tappets next to the posts, a battery-man should be able to strike both right and left-handed with equal facility.

J. E. Clark.

Los Angeles, May 7.

Unwatering an Old Mine.

The Editor:

Sir—In your issue of May 8 the question is raised by 'Problem' as to the proper machinery to install in unwatering a mine 1500 ft. deep, which is briefly described. I have recently had charge of an undertaking of a similar nature, and a record of my experience may be of value. At the mine in question several shafts had been previously sunk, all of which had caved, either at the surface or in depth. It was decided to repair and pump out the deepest shaft, which had caved at the surface, but was presumed to be intact below. This shaft had three compartments, and was about 900 ft. deep, being on an incline of 70 degrees. Although the vein was at a depth of about 30 ft., in sinking through the caved dirt from the original position of the collar, as indicated by the stringers on the old head-frame, no solid rock was found till a depth of 70 ft. had been reached. Here the original foot-wall side of the shaft was found, but the solid hanging wall was not reached until the shaft had been sunk 150 ft. Below this the shaft had not caved, but was filled completely with dirt caved from above. No timber was found in the dirt until the shaft was within 30 ft. of the ground-water level, which was at a depth of 260 ft., and no timber was found in place above 290 ft. Immediately above water-level the shaft was filled with broken and twisted rails and pipes, partly mixed with and resting upon a mass of timber, the old shaft-sets, which had apparently fallen before the rock gave way. Below 290 ft., that is, 30 ft. below water-level, the timber was nearly all in place, and there was no dirt in the shaft.

As the mine was situated on the railroad, with a spur to the shaft, steam was used for power, and the equipment for the first part of the work consisted of boilers and a small, double-cylinder geared hoist and a bucket. A larger hoist was also installed, and a 10-drill air-compressor, but these were not used until after water-level was passed. When the water was reached in the shaft, a No. 8 Cameron pump was used to handle it. This pump was run by air, and threw to a station-pump, run by steam, on the 250-ft. level. Below 290 ft. the water was pumped out of the shaft by two No. 8 Cameron pumps or one No. 10, run by air, and throwing to station-pumps set at intervals of 200 to 250 ft. A No. 9 Cameron sinker was used part of the time, running with steam, but it made the shaft too hot, and when running with air it used more air than a No. 10.

In this case it would have been difficult, if not impossible, to have bailed out the shaft below the point where the timber was found in place, because of numerous platforms and timbers across the skip-roads, left there by the former owners when they were taking out pipes and rails while the mine was filling up. An air-lift was tried for a time, but it was found to be impossible to give it sufficient submergence, on account of the obstructions mentioned.

In the case mentioned by 'Problem' it will be necessary to have a hoist in any case, in order to repair the shaft, and if it is found to be possible to use a bailer, that will probably be the most convenient and inexpensive method of unwatering. In considering this, it must be remembered that bailing water from a flooded shaft is hard on a hoist, and that the wear and tear on the machinery would be severe, especially if only one bailer were used, and it might be necessary to replace the hoist before mining operations could be conducted on any but a small scale.

Lucien Eaton.

Iron Belt, Wisconsin, May 15.

The Editor:

Sir—Referring to the letter written by 'Problem' regarding the best method to be used in unwatering a mine on the Mother Lode in California, assuming that the total water to be pumped from the mine is now 40,000,000 gal., and that 90 days can be devoted to this work, my recommendation is as follows:

Install a 3-stage vertical turbine sinking-pump, direct-connected to a 30-hp. motor, and pump the water down to the 340-ft. level, to an old pumping station. At the 340-ft. level we would install a 3-stage horizontal turbine station-pump, direct-connected to a 30-hp. motor. The sinking pump would then be used to go down to the 700-ft. station, delivering the water to the station-pump at the 340-ft. level. Upon reaching the 700-ft. level a duplicate station-pump would be installed and sinking pump used to go down to the 1000-ft. level, delivering water to the station-pump at the 700-ft. level. A duplicate station-pump could then be installed at the 1000-ft. level. The electric sinking pump could then be used on the 1500-ft. level, taking the water out to a depth of 350 ft., or 1350 ft. below the surface, at which point a new station would be made and a duplicate station-pump installed. The sinking pump would then continue to the bottom of the 1500-ft. shaft.

With this arrangement there should be provided, and held on hand for emergency use at the mine, one extra duplicate station-pump with motor, for immediate service in case of a break-down on any of the station-pumps. There should always be provided and kept on hand at the mine duplicate parts of the station-pumps that are liable to breakage, such as shafts, impellors, etc. Under this arrangement each of the pumps mentioned would have a capacity of 200 gal. of water per minute, so that the mine could be unwatered in the time specified. The approximate cost of the sinking pump, 5 station-pumps, electric hoist for handling the sinking pump, transform-

ers to transform from 11,000 volts down to 440, would be $10,000, delivered at the mine.

The size of the shaft will not permit of the use of any type of pump other than a turbine or a Cornish pump, which would have a capacity of 200 gal. per min. The efficiency of the turbine pumps would be 60 to 65%, under the conditions specified, whereas on the Cornish pump we do not believe that, when the rods and bobs are taken into consideration, the combined pump efficiency would be over 40%. If a well constructed turbine pump be used, with ample bearings and placed on a good foundation, the danger of break-down is no more than is experienced with a Cornish pump, and the damage resulting from a break-down would almost entirely be eliminated by having on hand a complete duplicate station-pump, which could be set in place quickly and put in commission. For the conditions as outlined I claim for the turbine over the Cornish pump, that the first cost would be cheaper, the cost of installation less, the efficiency higher, and the flexibility regarding capacity greater.

E. P. McMurtry.

San Francisco, May 7.

Simple Control in Cupelling.

The Editor:

Sir—The following method of cupelling is by no means new, but a description may be of value to any assayer who has never heard of it. It is used at Mina Santa Francisca, Asientos, Mexico.

In the front of the muffle a row of old cupels is placed bottom side up to keep the cold air from striking the first row of cupels. The muffle is filled with new cupels, excepting an inch or two at the back. The reason for omitting the last row is not that they would work too hot, but that as a rule any assays freezing are in the farthest row in the muffle. While the cupels are warming the fire is fed with fresh coal. When the cupels are thoroughly heated the lead buttons are dropped in. Often it is not necessary to close the muffle door, and before the last cupel is dropped into the cupel over half of the assays are opened and driving. This indicates at what heat we try to work. Nothing is done to the fire during the cupellation unless the heat has fallen a little. Naturally this temperature would volatilize some of the silver if no precautions were taken, but it is nicely regulated by means of a cooler. This cooler is nothing more than a piece of plate iron, 9 by 5 by ⅜ in., riveted to a 5-ft. handle of ½-in. round iron. It is held for a few seconds just above the hot cupels. For a fulcrum, one of the binders of the furnace which happens to pass level with the bottom of the muffle is used. When the assays have the correct temperature, or when the plate has become hot, it is withdrawn and plunged into a can of water. As a rule, the assays near the sides of the muffle will be hotter than those at the centre; then only the corresponding parts of the cooler are plunged into the water, so when the cooler is again slid into the muffle it will have the cold part nearest the hot cupels.

I can recommend this simple method to any assayer having a large number of silver assays at one time to carry through. It permits filling the muffle and getting good results on all. With a little practice feathers can be produced on every cupel in the muffle.

G. N. Pfeiffer.

Asientos, Mexico, July 25.

Furnaces for Melting Calcines.

The Editor:

Sir—The building of reverberatory furnaces for use in smelting calcines to produce matte involves certain difficulties which may be best met if the following requirements are kept in mind:

1. The furnace hearth should be long, so as to give room for a region of melting at the highest temperature, and another space or region for the settling or separation of the matte from the slag. The first region should be 50 ft., the second 100 ft. long. Edison in his clinker-burning, revolving-cylinder furnace, used in the making of portland cement, found 150 ft. not too much.

2. The charge should be dropped within the first or melting region where the heat is the highest. Here it spreads out, absorbs heat, both from the liquid bath of matte and slag below, as well as from the heated gases above it. Until we get above the melting point of the charge the heat is useless. According to good observers, and to experiments on the rates of cooling, the speed of heating varies by at least the square of the difference of temperature between the hot gases and the melting point. Thus at 1400° C. the speed of melting would be twice that at 1300°, the melting point of the charge being 1200 degrees.

3. If the air for combustion is pre-heated, the heat obtained is considerably more intense than that from direct firing. Thus by heating the air to 800° C. it is possible to add 10% to the temperature of the gases, or, in place of 1400° in the above example, we would have 1540°, and the speed of melting would be increased by 2.2 times over what it would be at 1400 degrees.

Powdered bituminous coal, as shown by experiments at the Highland Boy smelter, offers considerable advantage over direct firing. In that experiment, using a 40-ft. furnace, the gases were sent into the outlet flues at a temperature so high as to fuse the brick-work.

L. S. Austin.

Houghton, Michigan, May 15.

Mine-air samples, 25 in number, taken to ascertain the effects of smoke-powder, were reported as follows by the Government chemists on the Rand:

No. samples.	Combustion product.	Per cent in air.	No. samples.	Combustion product.	Per cent in air.
25	CO_2	0.301	13	CO	0.008
11	CO_2	0.517	3	CO and CO_2	0.000

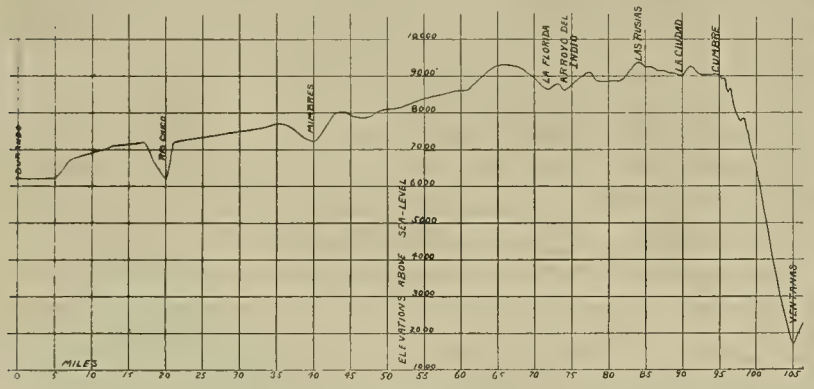
The normal amount of CO_2 in the atmosphere is about 0.03 per cent.

Magnalium, a new alloy of magnesium and aluminum, is said to be lighter than aluminum and as strong and malleable as brass; it can also be easily turned, planed, and drilled.

MULE-BACK TRANSPORTATION OF SECTIONALIZED MACHINERY.

Written for the MINING AND SCIENTIFIC PRESS
By F. C. ROBERTS and WALTER W. BRADLEY.

The subject of mule-back transportation is an old one. Because of its many supposed limitations and 'impossibilities' this form of transport has usually been considered applicable only to small plants. A notable example of the sectionalization of large-capacity power, mining, and reduction-units, and the transportation of this plant to districts accessible only by mule-back, has been recently afforded in the case of the Ventanas Mining & Exploration Co. in Durango, Mexico, with which the writers were connected as consulting engineer and assistant manager, respectively. The success attained makes pertinent the query, how many manufacturers of mining machinery appreciate the potentialities of business expansion by designing large units sectionalized for mule-back transport? One deterrent has been the 'time honored' load-limit of 350 lb. The fact is that with proper organization of crews, good food, and by the exercise of judgment in assigning loads best suited to certain animals it is possible to handle over heavy mountain trails, loads of 475 to 500 lb., and when necessary as much as 680 lb. in one piece. In the accompanying illustration is shown a mule carrying a section of $3^{15}/_{16}$ in. steel shafting, weighing 580 lb. The town of Ventanas or Villa Corona, as it is officially known, is situated about midway between the city of Durango and the Pacific port of Mazatlán. It is about 20 miles south of San Dímas, Durango, but it takes two days to make this short journey. It is at an altitude of 1700 ft. above sea-level. Access to the camp is circuitous and difficult. Leaving Ventanas, there is but one route of descent, that along the river-bottom in a westerly direction. The town is accessible by mule-back transportation from Durango practically throughout the whole year, and from Mazatlán for about seven months, either journey requiring about 10 days for pack ('carga') miles. The profile given above will help to convey an idea of the altitudes and conditions met on the trail from Durango to Ventanas. 'As the crow flies', it is approximately 65 miles; but by the route followed it is 105. As already stated a 'carga' mule usually requires 10 days to make the journey; but with a saddle animal, a man may make it in three or four days.



Profile of Route.

The veins in the district had been worked in a small way many years ago, first by Spaniards, afterward by Mexicans, and later by four Americans who wandered there nearly 40 years ago. Since they were dependent upon high-grade ore their operations were necessarily restricted; and during the last 10 years or so, they installed almost every type of small-unit plant that had been placed on the market, and they attempted nearly all the metallurgical processes described in the text-books, in an endeavor to treat the lower-grade material. While their efforts were not altogether successful, they deserve a great deal of credit for persistence and pluck in facing unfamiliar conditions of living.

The Ventanas M. & E. Co. had practically agreed to undertake the purchase of the group of veins in the district, and to erect a reduction-plant and hydro-electric power-plant before it was by any means certain that manufacturers would undertake to sectionalize many of the important machines. The capacity of plant fixed upon was about 200 tons (dry weight) per day, the experimental and metallurgical tests indicating that both in initial cost and in economic treatment of the ore, an 'all-slime' plant was most effective. The fineness of the product was to be maintained so that 90% would pass a 200-mesh screen. The plant was designed and erected by F. C. Roberts, consulting engineer. The selection of the machinery was made with a view to careful sizing and to 'step-crushing', and the capacity of the units was so fixed that the aerial trams, rock-breakers, and sorting-belt were required to be in operation only 10 hours per day. The plant was projected with the idea that the ore should be made to suit the individual units, that is to say, it was contended that the most economic results would follow if the product assigned to each unit was maintained at such a degree of fineness as would best harmonize with the design of that unit, providing, of course, that the selection of units was a wise one. All was planned with the intent that tube-mills should be used as the final crushing-device.

The ore is delivered to a central crusher-station by two automatic aerial trams, furnished by the A. Leschen & Sons Rope Co., of St. Louis, Missouri, and discharged to grizzlies set with 2-in. spacing, the undersize falling directly into bins below, and the coarse to sorting floors convenient to the jaw-crushers. The coarse-crushing equipment, Blake crushers, belt-conveyor, trommels, and rolls, came from the shops of the Allis-Chalmers Co. The sectionalization of these was made up of standard sizes furnished by that firm.

The use of rolls was an experiment in this case,

prompted by the knowledge that skilled labor for stamp-mill practice was considered to be hard to get, and the fact that the pioneers of the camp had used rolls for some years which ran largely without attention, and much better with poor administration than any stamp-mill either of the writers had ever seen. Besides this, Mr. Roberts' preliminary experiments indicated that for producing a ⅛-in. product, the rolls gave a lower percentage of slime, and the capacity per horse-power was greater than perhaps could have been obtained with stamps. From the de-watering cones below the finishing rolls, the product is equally divided among 3 Abbe Engineering Co.'s tire-type tube-mills, a fourth mill being used for the oversize. This oversize is elevated from the 4 separating cones below the tubes, by a 22-ft. tailing-wheel, the overflow going direct to the treatment tanks. The agitation plant consists of fourteen 30 ft. diam. by 10 ft. deep steel tanks, equipped for mechanical agitation. After a charge is treated it is transferred to a collecting vat, and thence to a vacuum-filter, then passing through a sand-filter to extractor boxes, filter-presses, and to sumps from which it is pumped back for service. Ground was broken on January 23, 1907, and the tube-mills were first turned over for service on July 19, 1908, the entire plant beginning operation on August 10, 1908.

All machines in the plant are operated by separate 8-40-900-60-2080 General Electric induction motors. There are 14 of these 40-hp. motors, and three 30-hp. Power is furnished from hydro-electric plant situated 5 miles up the river from Ventanas, consisting of 2 impulse water-wheels, furnished by the Pelton Water Wheel Co., of San Francisco, controlling three 12-200-600-60-6600 General Electric alternators. The hydro-electric installation was particularly interesting work; not only because of the theoretical accuracy of the machine supplied by the manufacturers, shown later in the practical efficiency of both water-wheels and generators, but also in the engineering difficulties attendant on the selection of the ditch-route.

As regards sectionalizing, the aerial tramways, although not involving intricate engineering problems, required the exercise of a great deal of care in order to keep within proper limits of weight and to retain the strength where it was required. The method of transporting the cables is shown in the illustration. The coils were made up and tied with wire in the factory before shipping, each mule's load being divided into 2 parts, with about 12 ft. of cable between each pair of coils. The 1-in. track-cable weighed 1.64 lb. per running foot; the ⅞-in. track-cable 1.20 lb.; and the ⅝-in. traction, 0.68 lb. The coils were so arranged that each mule-load was about 236 lb., or 144 ft. of 1 in., 230 lb. or 192 ft. of ⅞ in., 240 lb. or 354 ft. of ⅝-in. cable. Twelve mules carried the 2300-ft. length of ⅞-in. cable. The largest piece of 1-in. cable required 26 mules for its transport. One man was assigned to each 2 mules. The mule at the head of the line was controlled by a lead-rope, and each mule's lead-rope was fastened to the pack of the mule in front of it. In this way, they were kept at a uniform pace, and with the men distributed as indicated, the entire train could be stopped simultaneously when necessary to tighten up the cinches, or for other purposes.

The four tube-mills, 20 ft. long by 4 ft. 6 in. diam., were, we believe, the first units of these dimensions and capacity to be sectionalized for mule-back transportation. Each mill is supported on 4 well-spaced, chrome-steel roller-bearings, the heavy bed-plates to which the bearings are fixed being cut longitudinally and transversely into 4 sections, 2 male and 2 female, the inside and bottom surfaces being finished true, and firmly held in position with 1⅛-in. bolts. The locomotive tires were cut vertically into 2 pieces, each piece being a ring 5 ft. 3 in. inside diameter, 2½ in. thick, and 3 wide, weighing 350 lb., finished on the inside, bored tapering to fit the packing-rings, and held in place with lug-bolts. All packing-rings, flanges, and gear-wheel castings were cut in 2 parts. The steel shell of ½-in. plate was cut into 3 butt-jointed sections, each of which was made in 3 segments formed to proper radius, with heavy longitudinal butt-straps. The cast-iron flanges holding the shell-sections in place were riveted to the shell and bolted together. The tube-mill parts were necessarily quite heavy, and some of them offered a little trouble. Perhaps the most difficult loads to handle were the bearing rollers, not so much because of the weight (385 lb.), but because they rested high on the 'lomillos'—a small wooden crib made of four 4 by 4-in. blocks, which rests on top of the saddle. The locomotive tires were also difficult to handle, and the cast-iron heads, because of their large diameter and frailness, required a man to each mule.

The tanks of the cyanide plant, eighteen 30 ft. diam. and 10 ft. deep, and five 24 ft. diam. and 8 ft. deep, offered no mechanical difficulties, but made a large number of plates and an excessive amount of riveting. It was necessary to retain an area not to exceed 17.5 sq. ft. per plate. The maximum size of plates was 5 ft. by 3 ft. 6 in. Each 30 by 10-ft. tank contained 110 plates, about 50 of ¼-in. at the bottom and 60 of $^{3}/_{16}$-in. on the sides. Besides these were the top and bottom angle-irons, which were cut into 10 segments each. There were in all about 2500 plates to handle, and about 175,000 rivets were driven. The line and counter-shafts of the tanks, made about 500 ft. in all, reducing from 4½ in. diam. down to 3 in., and the greatest length handled was 15 ft. 10 in. The vertical agitator-shafts, 13 ft. 6 in. long by $3\,^{15}/_{16}$ in. diam., were each taken in one piece, weighing 580 lb. These were carried on picked mules, and 2 men assigned to each mule, one man ahead with the lead-rope, the other behind to steady the load and prevent it from swinging and see-sawing. Heavy pieces like these were handled in relays, changing mules about every 2 hours. One of these shafts is shown in the illustration opposite.

Friction-clutches (Imperial type) were heavily designed not only to overcome the usual starting load of about 15 hp., but to care for such emergencies as when a careless shiftman allows the density of the charge to reach a point equal to 2 charges. The heaviest pieces of these clutches weighed 480 lb. each. The cast-iron crown-wheels, and crosses for

agitator-arms were made in 4 parts, held in place with shrink-rings, bolts, and keys. Outside of the crushing-units and power-plant, there were no pieces which gave great trouble. Pumps up to 300 gal. per minute under 180-lb. pressure, as well as centrifugal pumps up to 6 in., and horizontal, straight-line compressors of a capacity up to 400 cu. ft. of free air per minute, can be dismantled without much trouble, excepting the bed-plates, which generally require to be specially cast in two or more pieces. One of the accompanying illustrations shows the section of a shaft for the mine-hoist, weighing 420 pounds.

The design of the hydraulic plant kept the individual pieces well within the packing limit, but with the extremely careful workmanship and finish, and the fact that many of the cores were bored for a driving fit-bolt, it was as rigid when assembled as could be asked for. This plant included 2 double, 26 in. diam., impulse-wheel units, bed-plates, bearings, shafts, housing, etc., together with 980 ft. of pressure-pipe and 1500 ft. of grade-piping. Some sections of the ¼-in. gauge, 26 in. diam. pressure-pipe, which was furnished in 5 ft. 6 in. lengths, by reason of its weight (396 lb.), and the 30 in. No. 10 gauge grade-pipe, by reason of its bulk, gave some little trouble.

All of the electrical units were assembled and wound at the mine. The 200-kw. generators were housed in skeleton-type frames, cut into 2 pieces, with short legs bolted to a divided bed-plate. The heaviest part of the generators were the shafts, weighing 520 lb. each; while in the induction motors, the rotors weighed 480 lb. each, with shaft pressed in.

The fact that the largest stick of timber possible to transport was 10 by 10 in. by 11 ft. long, and that most of the heavy work was made up of 8 by 8 in. by 11 ft. material, necessarily restricted the design of woodwork to certain limits and called for odd spans in order to avoid waste. It also resulted in an enormous amount of splicing, building up, trussing, and bracing; besides consuming large quantities of iron in bolts, rods, plates, and brackets. The main timber-district is some five hours from the town of Ventanas, at an elevation of about 8000 ft. above sea-level. A saw-mill of 5000 ft. B. M. daily capacity was put up; and a total of 600,000 ft. B. M. of lumber sawed and packed out on burros and mules. The burros handled the lighter stuff, such as 1 by 12 in., 2 by 4 in., and 4 by 4 in. Some 200,000 ft. B. M. of this lumber was used in flume-construction for the hydro-electric plant.

In the timber transport, each mule carried from 88 ft. B. M. (2 pieces of 6 by 8 in. by 11 ft.) up to 117 ft. B. M. (2 pieces of 8 by 8 in. by 11 ft.), with the average running about 110 ft. B. M., due to the larger number of 8 by 8 in. handled. The 600,000 ft. B. M., therefore, made about 5500 mule-loads, or 16,500 mule-load days, as the round trip required three days between the saw-mill and Ventanas, and also between the saw-mill and the supply-point for the ditch line, whence it was handled by men. As for weight, 2 pieces of 8 by 8 in. by 11 ft. would weigh from 350 to 400 lb., depending on whether it was well seasoned or not, while a few very pitchy sticks, which were actually weighed, tipped the scales at 620 lb. for the pair.



Agitator Shaft of 3 15-16 Diam., Length 13 Ft. 6 In., Weight 580 Lb.



Tramway Cable 2300 Ft. Long Loaded on Twelve Mules.

In anticipation of the enormous transport job ahead, the first work undertaken was the building and repairing of about 150 miles of trails. Labor was scarce and was drawn from both the high and low country, but it was not long before it became evident that higher efficiency was obtained, and the cost of accommodations lessened, by separating the coast-men from the mountaineers. At best, the hot-

country natives are not overburdened with clothing, and they simply cannot thaw out in the cold climate of the mountains.

Next came the purchase of pack-mules, organization of permanent trail-gangs for repair work, distribution at convenient points of blacksmith outfits and tools, mule shoes, etc. Not of the least importance was the purchase at market rates and distribution of immense quantities of corn and 'paja' for mule-feed. The purchase and organization of a large pack-train on company account does not at first suggest economy, but having an intimate knowledge of the Mexican packer or *arriero* and having observed the treachery of the packers as revealed in heavy castings lying on out-of-the-way mountain trails, and having 1500 tons of heavy, awkward, mining machinery at the railroad terminus, a staff of expensive skilled foreigners, and a force of skilled Mexicans at the mine, this course was justified in order to ensure a constant supply of material for the construction gangs, and at the same time to exercise control over the transport-rates.

A few Mexican transport-men will take an occasional load of 425 lb. at absurdly high prices, generally at a figure representing three times the value of the mule; but we had many pieces which were absolutely refused at any price. We have known instances in Mexico in which a company has had a heavy piece of machinery left somewhere along the trail after as much as $125 had been paid for its transportation to the mine. It is customary to advance to packers from 30 to 50% of the total price when starting, and it is not uncommon for them to take half a dozen loads a couple of days out and leave the *carga* scattered along the trail, and migrate, if more than one forwarding agent is handling material.

Our next task was perhaps the most difficult of all, to convince our own packers, as well as outsiders, that the intention was to transport this 1500 tons of heavy awkward machinery to Ventanas. The more enlightened public, after visits of inspection to the railroad station, held animated discussions to determine who was most destitute of reason—the engineer who undertook the design and erection of the plant, or the company that elected to pay for it. The usual day's journey for a pack-mule is from 5 to 6 hours, and during the rainy season (June to November in Durango) the animals are generally turned out and allowed to graze on the new sweet grass, which they prefer to the more substantial corn. Consequently they soon lose their strength to such an extent that they cannot stand up under an ordinary load. In this respect, as well as in the matter of the length of 'jornada' (daily journey), and the weight of loads, a material departure was made from the usual custom, tying up the mules and feeding them. By reason of slippery trails, heavy loads, and 'green' mules, we lost, in all, 38 animals during about 16 months of steady work.

The Mexican *aparejo* (pack-saddle) is a large leather bag, divided so as to hang equally over both sides of the mule, and is padded with straw and held in place by heavy breeching and cinches. It covers well the mule's back, and is really better adapted for packs of all weights and dimensions than the pack-saddles of the western United States. When well secured with the 'diamond hitch' thrown by an experienced *arriero*, there is little danger of the load shifting. A good pack-mule, *aparejado* (wearing the pack-saddle) is worth from $47 to $65 U. S. currency, and a poor mule is dear at any price. Effective work depends to a great extent upon the selection and assignment of loads, the *arriero* being guided by the gait and build and degree of 'mulishness' observed. Some mules will worry themselves into a state of exhaustion with a load that they have made up their minds does not suit them. The amount of intelligence displayed by pack-mules is sometimes marvelous. The affection that is shown for the *yegua* (bell-mare), without which a train cannot be managed, reflects another side of the mule's character, which Mark Twain so aptly described when he said "a mule would make love to its keeper for 10 years or more in order to get a chance to kick his head off."

The company's pack-train equipment, comprising about 150 mules, though traveling together, was divided into 3 trains, each having its separate camp and cooking outfit, saddle-man, cook, and force of *arrieros*, with a head-packer in charge of the entire equipment. While, as stated before, the company established supply and storage-stations for corn at convenient points along the route, it was not possible to have these at every stop the trains would make. For this reason, with a 50-mule train, there would be about 8 mules carrying corn and camp-equipage. The consumption of corn averaged from 4 to 6 litres per day per mule, this being divided into a morning and an evening feed. During the 16 months the price paid for corn delivered at supply-points was from $5 to $7 per *carga* of 2 hectolitres. Besides the company's mules, a large number of outside pack-trains were employed, as well as numerous burro-trains carrying the lighter stuff, such as cement.

The loads are generally referred to as *carga*, meaning two or more packages weighing up to 150 or 160 lb. each, and *cuarteo*, a piece which by reason either of weight or bulk can only be handled singly. In selecting the *carga* or *cuarteo* for the mule, or the mule for a given load, in one case, the excessive weight would be the predominating factor, in another the bulk, shape of the piece, and difficulties of balancing the load on the saddle. For example, in one of the illustrations is shown a load consisting of pump pinion-shaft with pulley and pinion attached. Mules which are broken to the *carga* cannot well handle *cuarteos*, and vice versa, because of the difficulty of balancing. We have seen mules which could readily handle a *carga* of 420 lb., stumble and flounder about and wear themselves out with a *cuarteo* of 250 lb. Hence, it is advisable to select the mules for each class of service.

Mules broken to carry timber are not effective on other work, and so on. A good *arriero* will almost instinctively select the load best suited to the mule, and will also balance the load perfectly. If this be not done, many mules will be ruined in short order. It pays to be ready to help the Mexican *arrieros*, if you find them in difficulty on the trail, because in

trouble, they are perfectly willing to sit down for weeks, not valuing time nor appreciating the need of rushing things. One difficult matter in handling such a large number of pieces, and packages, and so large a variety of parts, was to have the material forwarded in the sequence of erection. It was no easy matter to identify a given part because of the sectionalization. This was largely overcome by



Timber Transport.

painting with conspicuous colors the pieces as required.

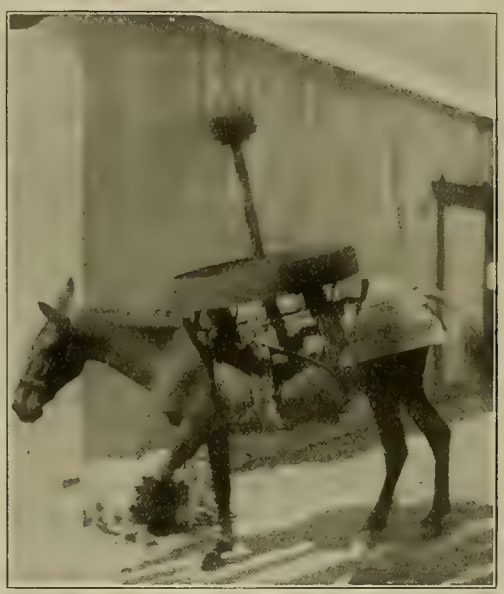
The freight rate for an ordinary *carga*, namely, two pieces, weighing 138 kg. (304 lb.) from Durango to Ventanas, fluctuates between $4.25 and $6 per *carga*, or between $29.25 or $42 per metric ton, an approximate average cost of $32.80 per short ton; while, for individual pieces weighing up to 425 lb., that is, *cuarteos*, a special charge of from $10 to $100 is made. The railroad rate from any centre in the United States to Durango is $1.60 per 100 lb. or $32



Section of Shaft for Mine Hoist; Weight 480 Lb.

per short ton. Add to this the local expenses for discharging, transferring, re-packing, etc. (another $2 per ton), and the respectable total of $66 per ton is reached, besides the duties. From Mazatlán the facilities were not so good; but we had only a small part of our stuff to transport from there. The rate from Mazatlán is $1.60 per 100 lb., and the ocean rate to that port from San Francisco is $5 per ton. There is no reason why San Francisco should not obtain all the West Coast business, particularly now with the Cananea, Rio Yaqui & Pacific branch of the Southern Pacific railroad practically exploiting the interior by way of Guadalajara, freight could be handled by boat to Mazatlán or Manzanillo, and thence by rail to the interior.

About 2500 tons of material (1500 tons of machinery, and 1000 tons of supplies and stores) were transported during a period of 16 months. A small part, as already stated, came by way of Mazatlán. It made 17,500 mule-loads, or 262,500 mule-load days, taking 15 days for the round trip. Out of this lot, but 4 pieces of castings were broken, 1 motor-rotor, and 10 tank-sheets lost (out of 2500 sheets). There were 12 packages or pieces lost by the railroads. There were but two pieces of the plant which were not delivered at Ventanas, namely, the bed-plates, with guides cast on, of a Deane horizontal duplex pump, weighing 720 lb. each. These were sent by mistake, and were taken within 10 hours of Ven-



Pump Pinion-Shaft With Pulley and Pinion Attached.

tanas, before the properly sectionalized bed-plates arrived and the mistake was discovered. There they no doubt will remain for a long time as monuments commemorating those gallant mules.

According to the Geological Survey reports, the bauxite industry in 1908 was still suffering from the effects of the depression of the preceding year. The production for 1908 was 52,167 long tons, valued at $263,968, a reduction of about 47% in quantity and 45% in value. Little or no prospecting or development work was done, despite the fact that numerous new deposits were discovered. The list of producing States is still restricted to Alabama, Arkansas, Georgia, and Tennessee. As in the past, Arkansas leads, producing more than 60% of the total, and this notwithstanding a decrease of about 43% in its production. In Tennessee only one firm is engaged in bauxite mining.

In both quantity and value of output the United States stands at the head of the salt-producing countries of the world.

FOREST SERVICE AND MINING CLAIMS.

The relations of the Forest Service to miners has been productive of much friction. Following numerous protests made by the miners, the American Mining Congress appointed a committee to confer with Gifford Pinchot, Chief Forester. Two conferences were held, on March 15 and March 18 of this year. The outcome of the action of the latter is set forth in the following letter just received by the Mining Congress from Mr. Pinchot. It will be noted that Mr. Pinchot states that efforts will be made to develop a plan whereby the restrictions of the Forest Service will cause no injustice to any mining man. As further conferences will be held with Mr. Pinchot by the Mining Congress committee, those who find any of the regulations of the Forest Service inequitable should communicate at once with the American Mining Congress Forestry Committee, Denver, Colorado.

Gentlemen:

Following what was to me our most promising conference at Denver, upon my return to Washington I have taken up with the legal officers of the Forest Service, as I told you I would do, the preamble and resolutions adopted by the Forestry Committee of the American Mining Congress, which we discussed in Denver, March 18. These resolutions contain two principal statements. The first in importance is:

"That we highly appreciate the courtesy received and the consideration given us to our arguments at the recent conference on the 15th inst., and the prompt compliance with our request for a modification of the ruling and the practice in regard to the examination of and reports upon claims for which application for patent has been made, and wish to express our entire satisfaction with such modification, which we understand to be, that mining claims in any National Forest apparently valid, and held in good faith for mining purposes will not be further examined unless the passage thereof to patent would be perjudicial to the interests of the Government if the said claim should in fact be found to be invalid. No claim will be protested except upon a report by a qualified mining man which gives facts which tend to show the invalidity of the claim.

One of the objects which both your Committee and the Forest Service is most anxious to attain, as I understand it, is to minimize the necessity for having Forest officers consider the validity of mining claims in making statement of fact to the Department of the Interior. Accordingly, I propose to modify the rule in execution of that part of your resolutions just quoted so as to make it read as follows:

Mining claims in any National Forest apparently held in good faith for mining purposes will not be further examined unless the passage thereof to patent would be prejudicial to the interests of the Government if the said claims should in fact be found to be invalid. If any such claim is apparently not held in good faith for mining purposes, it will be examined by a qualified mining expert to ascertain the true condition, and the report of such mining expert will be submitted to the Department of the Interior for its consideration.

This rule goes even further than the agreement reached in Denver, and will, I believe, meet with the approval and support of all legitimate miners.

The second statement of the resolutions is:

"A ruling of the Department of the Interior which is being enforced by the U. S. Forestry Bureau prohibits the claim owner from taking timber from a valid lode claim location for the improvement and development of another claim in the same group is, in the opinion of the Committee, contrary to the spirit and intent of the law, and the cause of much of the friction and dispute between the legitimate mining interest and the Forestry Bureau, and its enforcement entirely prohibits many from developing legitimate mining claims, and works undue hardship and irreparable injury to many others."

The rule to which your resolution refers is one made under authority of the Secretary of Agriculture, and not by the Secretary of the Interior, as I myself supposed and told you in Denver. When the National Forests were in charge of the Department of the Interior, such a ruling was made, and the Secretary of Agriculture followed it when the Forests were transferred to his care. A contrary rule obtains for unreserved lands. I do not believe, however, that it would be wise for the Forest Service to adopt for reserved lands the ruling of the Department of the Interior applicable to unreserved lands, which permits the owner of a group of valid claims to take timber from any claim of the group for use on another claim. The adoption of the rule you propose would require constant determination by Forest officers of the validity of the claims from which timber is cut, and that is just what we most wish to avoid. Furthermore, it could, in my judgment, have the effect of offering a premium on the timber as a temptation to locate claims not valid in themselves, and so would lead to never-ceasing conflict, and thus to the perpetuation or even aggravation of the very conditions we are seeking to avoid. No plan which multiplies the chances for trouble can be satisfactory.

But the Act of June 4, 1897, contains a provision which authorizes the Forest Service to grant free-use permits to miners, and I believe that the necessary immediate relief can be given by a liberal administration of that portion of the act.

The holder of a mining claim in a National Forest has the right to take timber from that claim for use thereon, or elsewhere, if such timber is used for the development of the claim from which it is cut. The regulations and instructions of the Forest Service (pages 70-75, Use Book of 1908) concerning the free use of timber on National Forests provide that timber to the amount of $20 in value can be secured from a ranger, and a supervisor can grant free use to $100 in value. And since the District Forester on December 1, 1908, became invested with the powers given the Forester by Regulation No. 23, such District Forester may now grant free use when necessary for amounts in excess of $100.

The Service desires that men engaged in prospecting or developing mining claims in the National Forests should have a liberal free use of timber from the Forests, if the timber on any claim is not sufficient for its development, so long as it is a prospect and

not a producing mine. When a prospect becomes a mine and begins to produce ore, it is then a commercial enterprise and no more entitled to free use of Government timber than any other business. This policy will be followed in the administration of the National Forests, and a conveniently accessible and permanent supply of timber for mining will be provided whenever practicable.

I believe that the free-use regulations of the Forest Service can be improved, and for that purpose I will at once issue the following additional instructions:

"In granting free-use permits, Forest officers should make every effort to provide, without unfairness to other interests entitled to consideration, and without injury to the Forest, that no prospector or miner working for the preliminary development or exploration of his claim shall be denied the free use of timber needed and suitable for these purposes within reasonable limits, if there is not upon the claim to be developed a sufficient amount of timber for such uses. Care should also be taken to avoid the marking for use under a free-use permit of any timber which cannot be used by a prospector or miner, or any small user to whom a free-use permit is issued. Large users of special material who operate, or can operate, sawmills may properly be required to take with such special material other merchantable timber which it is necessary to remove for the future productiveness of the Forest or to avoid rendering the remaining timber on the area unmerchantable. But it is believed that very few cases will arise which will make the enforcement of this restriction necessary as to free-use permits."

I hope that these new instructions will remove any possible doubt as to the friendly interest of the Forest Service in the mining industry.

I am sure your Committee is considering carefully the difficulties on both sides of the situation we have discussed, and fully realizes that the problem we are endeavoring to solve presents difficulties on both sides. I think you will agree with me that the necessity for examination of the validity of mining claims prior to application for patent should be eliminated as far as possible; and that everything in reason should be done to facilitate the efforts of the prospector and miner to open up and develop the mineral wealth within the National Forests. At the same time—and the Mining Congress has always been in hearty accord with this policy—the National Forests safeguard the welfare of many other interests, and have an important function in the upbuilding of the Western country. Therefore, they should be protected against injury, through mining claims or otherwise. That is what we all desire.

The Forest Service will be glad to co-operate with you in an effort to develop a plan, as nearly as possible automatic in its operation, which will prevent injustice of any kind. An extended examination along this line will be made during the coming summer by the Service, and the result of it will be laid before you in the fall. In the meantime I believe we may congratulate ourselves that real progress has been made. Very sincerely yours,

(Signed) GIFFORD PINCHOT, Forester.

MUREX MAGNETIC CONCENTRATION PROCESS.

*A new method of wet concentration which has been attracting the attention of the English metallurgists has been brought out by the Murex Magnetic Co., Ltd. It has reached the stage where it is prepared to negotiate for building working plants.

The process is divided into two parts: first, the separation of mineral from gangue, and second, the separation of mixed minerals from each other. The crushed ore is treated with a solution, mixed with a small quantity of water, and then passed under a single magnet. The recovery of mineral thus obtained is said to be exceedingly complete. The solution is then removed, and in the case of an ore containing only one or two minerals, such as lead and silver, which do not require further separation, the operation is at an end. Where a further separation is required (for instance, in a mineral containing lead and zinc), a second operation is necessary, as follows: no re-crushing is required, but the concentrate, after being dried, is mixed with a small percentage of the Murex solution and passed over ordinary concentrating appliances, whereby the different minerals are separated from each other. The quantity of middling required for re-treatment is a small percentage of the whole. The treatment of the slime presents no difficulties, and the 'float' is obviated. The solution which renders the minerals susceptible to such separation is called a 'magnetic solution'. The Murex Magnetic Co.'s process gives a magnetic property to the original minerals in the ore by adding a small percentage of magnetite and extracting, by means of a magnet, the added magnetite along with the original minerals, thus solving the problem.

A test on a low-grade Broken Hill ore, the weights and assays of which were taken by Arthur Claudet, gave the following results:

	Lead. %	Zinc, %	Silver, oz. per ton.
Crude ore	14.50	12.80	9.00
Lead concentrate	73.00	3.50	29.20
Zinc concentrate	5.60	44.00	8.20
Tailing	1.70	3.30	1.80

As no recovery of the zinc is at present obtained from this ore, the whole of it may be considered as additional value obtained. On this basis, the additional gross value of the recoveries in marketable products in favor of the Murex process, with lead at £13 per ton, spelter £20 per ton, and silver 26d. per oz., over the values recovered by the present treatment is as follows:

	Per ton of crude ore.
In silver—lead concentrate equal to	4s 4d
In silver—zinc concentrate equal to	5s 7d
Total	9s 11d

The Murex Magnetic Co., Ltd., owns the process for the United Kingdom, the Colonies, Germany, and Austria. The directors are the Hon. Lionel Holland, W. C. Bond, Alex. Stewart, Frank Owen, and Marcus A. Samuel. The manager is Julius Buss, and the consulting chemist Edouard Heberlein.

*Abstract from the Financial Times.

DREDGING INDUSTRY IN NEW ZEALAND.

By Arthur C. Buckland.

*Although New Zealand has led the way in the gold dredging industry until the present time, she is in danger of losing her position of proud pre-eminence. We have dredges in New Zealand that look more like heaps of scrap-iron than anything else; we have also mammoth machines, like the Earnscleugh No. 3, whose buckets have a capacity of 7 cu. ft., whose pontoons are 132 ft. in length, in beam 30 fr. and 7 ft. in depth. Her ladder permits dredging to 50 ft., and carries buckets of 7 cu. ft. capacity, while her tailing elevator stacks the tailing to a height of 70 ft. The fleet numbers over 200 dredges. With an average of 8 to each dredge, over 1500 men are directly employed. The annual coal consumption is estimated at 100,000 tons. This means many miners, and if we include the foundry work necessary, the number of men directly and indirectly employed by the dredging industry will approach 3000. All sorts and conditions of ships go to make up the fleet, and all sorts and conditions of machinery and engines may be found in them.

The laws guard as far as possible against accident on a dredge. Machinery guards must be in place, a stoppage must be made while oiling up, life-lines, life-belts, boats, boat-hooks, must all be provided, kept in good order, and placed in accessible positions. It is compulsory to have a first-class certified engineer in charge of the boiler and engine. Inspectors come around to see that these requirements are duly complied with.

The cost of a large new dredge is from £13,000 to £14,000, but dredges are frequently purchased and put to work for one-fourth that sum. Frequently land is worked on a royalty basis, but usually it is bought in 5-acre lots. During the boom in dredging the areas taken up were too small, and too many dredges were put to work side by side. Consequently nearly every dredge passed into liquidators' hands sooner or later and was put up at auction. Usually such dredges are eagerly snapped up by small working parties, who make them pay very well. The reason is that they are content with a fair wage each out of the returns. Suppose 4 men take over the dredge, they will think themselves well paid at £4 weekly each. A dredge that has given returns of 8 or 9 oz. per week will, of course, never pay dividends on some thousands of shares; but such ground will suit small working parties very well. When once the dredge has been repaired, they have no expenses except for coal. No secretary is required, and there are no directors' fees. In this manner dredge after dredge is dropping into the hands of the working parties; and in most districts it is only a matter of time before the large company with 10,000 shares, directors, and secretary will be a thing of the past.

There are many untried areas left in New Zealand. It appears as if the dredging had, with painful lack of originality, until now merely tried the vicinity of the old-time gold rushes. Dredges are with few exceptions found round about those areas that were richly auriferous and mostly worked out in the sixties. Such places are the Clutha river and its tributaries, the West Coast Provinces, Waipori, Switzers, Lawrence, in the South Island. It will be a good day for mining when systematic prospecting is carried on over some of the untried ground. This is in places somewhat difficult of access, such as Southland. In Otago there are at present about 100 dredges at work, in Southland 50, on the West Coast 40, and one can add a few that are working in Nelson and Marlborough.

The wages paid have to a great extent been settled by an arbitration court. Strikes in New Zealand are illegal. On any dispute arising as to wages, the matter must be referred to the arbitration court, which then fixes the wage for the district. In the more accessible districts this is at the rate of 8s. per shift of 8 hours for firemen and winchmen, while where living is dear, in out of the way spots, the wages rise to 9s., and in others to 10s. per 8-hr. shift. Overtime is in all cases paid at the rate of time and a quarter for week-days, and double pay for Sundays. The engineer receives from £3 to £5, the dredge-master £4 to £6.

As things are at present, dredging can scarcely be looked upon as a permanent industry. In time to come, however, larger dredges and improved gold saving appliances will result in the working of areas that are at present doubtful investments. Fortunately, the old plan of dumping a dredge onto a block of ground preceded by scarcely any reliable tests is now very rare. Boring is coming much into vogue in prospecting, especially where heavy drainage will not permit shaft sinking. Most of our dredges are turning over ground about 30 ft. at the most in depth, so that a hand-labor boring plant is quite able to give the ground the necessary trial.

*Abstracted from The Mining Journal.

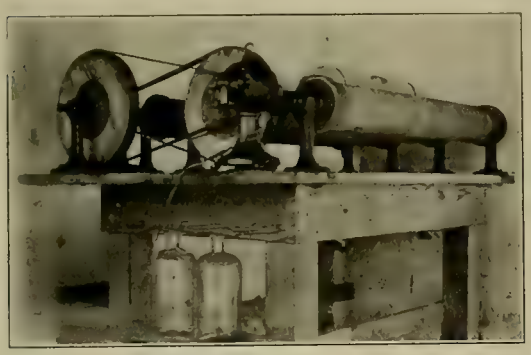
In the Rocky Mountain States—Colorado, Idaho, Montana, New Mexico, North Dakota, Utah, and Wyoming, the output of coal in 1908, according to the Geological Survey, amounted to 21,684,414 short tons, valued at $33,252,730. In 1907 the production in these States was 23,990,917 short tons, valued at $36,097,789. In not one of these States did the production in 1908 exceed that of the preceding year. The total decrease amounted to 2,306,503 tons; the decline in value was $2,845,059. Almost exactly 50% of this decrease in production occurred in Colorado, whose output declined 1,155,263 short tons. Nearly 40%, or 763,839 tons, was in the output of Wyoming. These two States, Colorado and Wyoming, contribute more than two-thirds of the total production of the Rocky Mountain region. The Pacific Coast States, which include the Territory of Alaska and the States of California, Oregon, and Washington, in 1908 produced 3,123,468 short tons of coal, valued at $6,976,-332, against 3,775,602 short tons, valued at $7,937,918 in 1907, a decrease in production of 652,134 short tons in quantity and of $961,586 in value. In California and Oregon there were small increases in production, but in Alaska and in Washington the production decreased. Of the total production in the Pacific Coast States, 97% is from Washington.

AGITATOR FOR CYANIDE TESTS.

Written for the MINING AND SCIENTIFIC PRESS
By G. H. CLEVENGER.
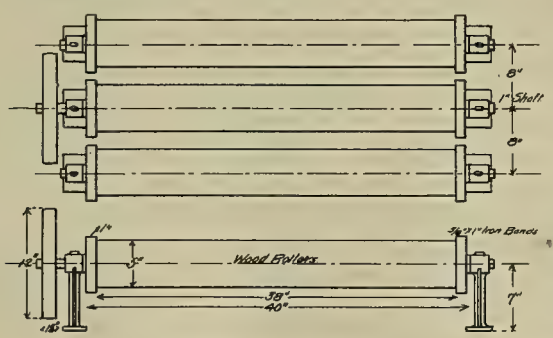
After designing and using several types of agitators, for making small cyanide tests, the writer has found that the machine herewith illustrated is the most convenient and satisfactory in every respect. It may be readily constructed in any mine-shop of ordinary equipment.

It will be noted that the machine is simply a series



Agitator for Cyanide Tests.

of large wooden rollers mounted upon a table or other suitable base. Large 2½-litre acid bottles are used as containers for the pulp; these are not filled over one-third full, or so that the pulp does not run out at the necks of the bottles when they are lying on their sides upon the rollers. By this method the agitation is effected in open bottles, and the annoyance of inserting corks is avoided. The test is made under conditions resembling treatment in an open tank. The wooden rollers are reinforced at their



Dimensions of Agitator.

ends by means of iron bands; these serve the further purpose of preventing the bottles from working off at the ends of the rollers. Two idle rollers may be successfully used upon each side of the driven roller. Increased capacity may be obtained by making the rollers longer. Any source of power may be used, but for an agitator of moderate size, a small electric motor will be generally found to be the most satisfactory. The driven roller should run at a speed of 30 to 50 revolutions per minute. At first, until the bearings become limbered up, it may be found necessary to place a couple of heavy rubber bands upon each bottle, in order to get the necessary friction for driving the idle rollers. Re-grinding tests may be readily made with this agitator, by filling the bottles about one-third full of small glass marbles, before adding the ore and solution. In this case it is best to use corks, which should be carefully attached.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

A. C. R., California: Specular hematite.

J. R. H., Alamos, Sonora, Mexico: Sphalerite.

W. E. C., California: Quartz schist with pyrite.

D. D. W., Elkton, Colorado: Specular hematite in a coarse quartz aggregate.

J. O. B., Smiths River, California: Schistose rock containing talc, with particles of magnetite.

F. A. F., Tehachapi, California: The specimen is too small; it appears to be a weathered acid lava, probably rhyolite.

G. T. H., St. Louis, Missouri: No. 1, fossiliferous chert; No. 2, dolomitic limestone with silica and sphalerite.

F. H. M., Johnson, Arizona: No. 1, a tuff, most probably andesite tuff; No. 2, acid andesite, or trachyte; No. 3, andesite charged with hematite.

O. B. A., White Hills, Arizona: No. 1, granite; No. 2, a garnet-quartz aggregate—a contact rock; No. 3, metamorphosed andesite; No. 4, quartzite; No. 5, diorite-porphyrite; No. 6, a dense fine-grained black trap, probably of the diorite family; No. 7, metamorphosed andesite; No. 8, weathered acid andesite; No. 9, porphyritic andesite, much metamorphosed; No. 10, porphyritic andesite, much altered; No. 11, indurated shale; No. 12, andesite.

J. H. H., Etzatlan, Jalisco, Mexico: No. 1, a somewhat decomposed rock, intermediate in character between diorite-porphyrite and andesite; it shows a slight content of hematite; No. 2, a metamorphosed basic rock, probably of the gabbro series, with fine-grained porphyritic texture; No. 11, a very fine-grained aggregate of galena, chalcopyrite, and possibly sphalerite, in quartz; No. 21, andesite; No. 24, quartz porphyry; No. 25, aggregate of galena and sphalerite; No. 26, andesite or basalt pebble with extreme surface weathering.

Sand-lime brick produced in the United States in 1908 had a total value of $961,226 and represented the output of 87 plants. In 1907 the output was valued at $1,225,769 and was furnished by 94 plants. The net decrease in the value of the output in 1908 was therefore $264,543. The average price per thousand received for common brick of this character in 1908 was $6.33, as compared with $6.61 in 1907 and $6.71 in 1906; for front brick the average price was $12.76 in 1908, as against $10.96 in 1907 and $10.42 in 1906. It is apparent, therefore, that while common brick has decreased in price, front brick has increased. A report on the condition of the sand-lime brick industry in 1908 will be published by the U. S. Geological Survey shortly.

NATURE OF GOLD IN ALLUVIALS.

Written for the MINING AND SCIENTIFIC PRESS
By F. LYNWOOD GARRISON.

The nature and process of accumulation of gold in alluvial deposits is a matter of practical importance of some scientific interest, and the subject is by no means as simple as may appear at first sight. That alluvial gold is a product of erosion derived from auriferous veins in neighboring hills and mountains is obvious. In many cases it is evident that the gold has been carried long distances from its source, especially when of a flaky character, which increases its suspensibility in water, and lessens the natural concentration tendency due to its great specific gravity. But the assumption that all alluvial gold is derived solely by erosion cannot be accepted as conclusively proved. Doubtless by far the greater part is thus accumulated, but there are evidences that a considerable amount of gold in alluvials may be due to precipitation from solutions as a chemical deposit. The rate or degree of this chemical deposition varies, and is affected or regulated by natural conditions, such as rainfall, evaporation or dryness of the air, temperature, grade of the streams, and the solubility of the gold as it existed in the rock deposits from which it was primarily derived. The character of the underground circulation is no doubt also an important factor, some waters carrying more alkaline or gaseous compounds than others, hence we have a dissolving power proportional to the content of the particular constituents that have a solvent effect upon gold. Thus, for example, water containing an appreciable quantity of the haloid salts will dissolve gold more readily than pure water. Louis thinks that gold is introduced into the deposits as an alkaline aurate and not as a soluble haloid salt.[1]

It may at first sight seem like thrashing out old straw to re-open this subject, but the more one considers it the more evident is it that a number of unsolved problems are involved. Twenty-five or thirty years ago the chemical deposition of gold in alluvials was extensively discussed by chemists and geologists, notably by Egleston, Selwyn, Lieber, Genth, Becker, and Doelter, and in later years, by Henry Louis and H. A. Gordon. The latter, in his paper on the 'Hysteromorphous Auriferous Deposits in New Zealand',[2] reviews the literature on the subject, and draws some valuable conclusions therefrom. Although the published investigations by the persons mentioned do not clearly so indicate, it is evident that they are satisfied with the soundness of the chemical hypothesis. Notwithstanding this fact, there appears to be at present a disposition to discredit all chemical deposition theories, objections being based apparently upon no substantial ground. Among a number of unexplained or but partly explained facts observed in connection with the study of alluvial gold deposits, may be mentioned the following:

1. The gold in alluvials is always purer than the average fineness of the gold in the neighboring vein-deposits; moreover, it seems to be a general rule that the minute particles of gold always contain less silver than the accompanying coarse particles. The grade of purity of placer gold is often assumed to conform in a general way to that of the original vein-gold; this is not correct, for it is indisputable that some of the silver alloyed with the primitive gold in the veins disappears as the gold is comminuted by attrition in the gravel.

2. Gold is sometimes found as nuggets and small particles in rocks which have never been moved by erosion from their original positions, but which have been decomposed to a considerable extent. Gold particles under such conditions are usually free or semi-detached in the decomposed material, the assumption being that such nuggets and particles were formed in place in the decomposing rock or vein-matter.

3. Veins carrying gold, especially auriferous copper deposits, are nearly always richer in gold near the outcrop, indicating that the more soluble copper minerals were dissolved with the weathering of the vein, leaving the gold behind. Subsequent erosion would of course carry these particles down into the stream beds, forming alluvial gold deposits or placers.

4. There is apparently no relative proportion between the richness of the alluvials and the richness of the neighboring vein-deposits. Some of the most productive alluvial gold mining districts in the world show few evidences of quartz deposits of sufficient size and richness to pay to mine under ordinary conditions. At first sight it might be supposed that rich alluvials must consequently have rich sources of origin, considered in a commercial sense, but this fact does not necessarily follow, since nature draws its stores of rich alluvial gold from innumerable small vein-deposits as well as from the country rock itself, concentrating the particles through long ages in the stream gravels and river bars. In this connection it is well to bear in mind that gold is not a rare metal, it is, in fact, a common one in certain districts, but in its primary condition it is widely scattered in minute quantities.

Concentration in veins and other lode deposits, through the agency of gases and the hot and cold solutions of the underground circulation, may be considered the first great stage in the formation of gold deposits. Accumulation by erosion and concentration in stream-beds and other alluvial deposits being the second and probably final condition. In California, as in the Nome and Yukon districts of the North, it has been the alluvials that have established the reputation of the districts, and not the lode deposits, which as a rule have been disappointing or wholly unprofitable. Other instances in different parts of the world can be adduced to illustrate this point. Indeed, even the great lodes that have made South Africa the greatest gold-producing region in the world are primarily of alluvial or sedimentary origin. It is true that the banket, or gold-yielding conglomerate of this region, is accompanied by eruptive dikes, which some geologists assume to have been the source of the gold, but the consensus of opinion ap-

[1] *Mineral. Mag.*, Vol. X, No. 47, p. 241. *Trans.* A. I. M. E., Vol. XXIV (1894), p. 186.

[2] *Trans.* A. I. M. E., Vol. XXV (1895), p. 292.

pears to favor its essentially sedimentary origin. The conglomerate in which it occurs was certainly derived by erosion, and the gold and pyrite which is closely associated with the conglomerate is rarely or never found in the quartz-pebbles composing it, but only in the surrounding cementing mass that binds these pebbles into a hard rock.

5. Whenever pyrite occurs in auriferous gravels, it invariably carries gold. Pyrite is not infrequently found deposited upon buried logs and tree-branches, thus showing the action of organic matter in precipitating iron sulphide and its associated gold under natural conditions.

The probability that gold is soluble in meteoric and underground waters may be safely conceded, and that it is precipitated by the action of organic matter is an accepted fact, but that it is in solution in sufficient quantity in the waters flowing through alluvial deposits to add appreciably in this manner to the gold accumulation in these gravels, is not so plain. It appears certain that beds which contain much organic matter are apt to be especially rich in gold. Solution takes place with great slowness, as does precipitation, hence the period of time necessary to transfer any great amount of gold by such means, as compared with that required to transfer it by the active mechanical processes of erosion and concentration, must be enormous. The actual importance of the chemical influences will depend upon and vary under different conditions and places, as, for example, the character and nature of the percolating waters, the presence of materials in solution capable of bringing about a precipitation of the gold, and the length of time during which these processes have had an opportunity to act. It is evident, therefore, that the importance of mechanical is vastly greater than that of chemical concentration. According to Spurr, chemical processes have had little to do with the concentration of gold in the Alaskan gravels. "The metal occurs in regular flat scales, like those which are found filling the cracks in quartz veins, and in a mammillary form, suggesting that deposition from solution has not been noted. The flat forms are best seen in the smallest grains, the larger masses having been generally somewhat rounded by contact with harder bodies, moreover the gold from the smallest to the largest fragments is often mixed with vein-quartz in all proportions, in such a manner as to leave no doubt as to the detrital origin of both."[3]

Egleston thinks that when the action is localized and slow we have placers with nuggets and irregularly shaped pieces, and when it is rapid we find the gold with small particles distributed through the sand. The same conditions which cause solution of gold in certain cases cause also the solution of silica. This explains the phenomenon of mammillary and apparently water-worn nuggets encased in quartz, while both the gold and quartz have been formed later than the gravel. Many causes which produce the precipitation of gold would also cause the reduction of soluble sulphates into insoluble sulphides, the gold being retained in the latter. This would account for the almost constant presence of gold in pyrite.

The experiments of Becker[4] and Doelter[5] on these points are most interesting and informing, and indicate that heat, and perhaps also pressure, increase the solubility. At this point it is desirable to call attention to observations of Liversidge upon the concentric character of some gold nuggets from New Guinea. The usual macro-crystalline structure is absent in these nuggets, and toward the edges a clearly marked concentric condition is manifested.[6] These two nuggets weighed 0.90 and 0.86 oz. respectively, and were found on assaying to be 889 and 882 parts fine, the associated metal being silver. When sliced, polished, and etched with aqua regia, small enclosures of hematite and quartz and also cracks and cavities became visible, but the usual amorphous structure was absent. Parts near the edges showed clearly marked concentric lines.

It is evident from these data that gold in alluvials is susceptible to some accretion by chemical precipitation, but it is certainly slight, and no one is justified in concluding from this fact that old and worked-out placers could appreciably enrich themselves within periods of time included within human history. The valleys of the tributaries of the Po in Italy, the rivers of the Central Plateau of France, and the Rhine in Germany produced gold from alluvial washings in the time of the Roman Empire, but probably they would not now pay to work, even with the most improved appliances. When both mechanical and chemical accretion has failed, as in these cases, to substantially enrich the river-gravels in a thousand years, the degree of accumulation must be exceedingly small, although of course it is well known that none of these streams drain notable gold-producing rock-areas. Mechanical accumulation of gold on river-bars after floods is, on the other hand, frequently rapid. In many gold-producing countries the bars have been worked by the natives year after year from time immemorial. They are not exhausted because the annual freshets deposit upon them a new supply of gold. This will continue as long as the sources of the gold at the head-waters of the streams are productive. In China certain streams have been worked for hundreds, or perhaps thousands of years, and still yield a profit to the patient frugal Chinaman, from gravels that would be considered by others too poor to work with the best equipped dredge under favorable conditions. This statement probably deserves some qualification, as it has been some years since the writer was in China, and the dredging art has taken great strides within that time, but the general principle enunciated is not changed.

The question of gold-accretion, both mechanical and chemical, in existing streams, is a subject worthy of thorough study, and must be taken up in the near future as our gold resources from new territory become more and more exhausted. The future source of gold supply for civilization's rapidly growing

[3]U. S. Geol. Sur., 18 *Ann. Rep.*, Part III., p. 379.

[4]Monograph, U. S. Geol. Sur., Vol. XIII, 1888, p. 433.

[5]*Chemische Mineralogie*, Leipsic, 1890, pp. 154 and 323.

[6]*Jour. and Proc.* Royal Soc., New South Wales, Vol. XL., p. 161.

needs is by no means sure, even for the next 50 years. Far be it from me to become an alarmist on this subject, but much thought, wide reading, and not a little travel have forced me to this conclusion. It is becoming more evident that gold will become dearer in its relation to food, notwithstanding a tremendous increase in its production. Doubtless many partly exhausted alluvial deposits can be profitably re-worked with our steadily improving mechanical appliances, especially with dredges, but the extent of territory that may be profitably dredged is becoming more and more restricted each year, and sometimes one is disposed to conclude that where the conditions for the practice of this art are favorable the areas suitable never have been and never will be found to be extensive.

It has been remarked by Posepny that the concentration of gold at the base of placers during the time of their deposition as fluvial accumulations, cannot be easily explained. A natural settling process we are not justified in assuming, for the reason that the material of the placers usually shows no indication of a sorting or classification of its material, but on the contrary is composed throughout of particles varying greatly in size and weight. In fact the loose débris forming a placer was not all at once moved or even stirred by the water, but was deposited at different periods, layer upon layer.[7] Posepny considers that concentration of the gold on the bedrock took place after the deposition of the gravel by a simple mechanical slipping downward of the gold particles, with the aid of water, through the interstices of the gravel, just as in the case of pulp left standing for a considerable period, and also in piles of mixed ore, even when undisturbed, it is found that the galena tends to settle and accumulate at the bottom. This, however, does not explain the condition satisfactorily, for frequently, if not in most cases, the gold is concentrated in streaks or layers that are often many feet above the bedrock, and there are frequently several such layers. This is true of old gravel benches or deposits, as well as of those in existing streams. Moreover, they are sometimes richer in gold than the gravel resting directly upon the bedrock. The question appears to be an enigma the probable explanation of which is to be sought in the currents of the streams depositing the gravel.

Rustiness of gold[8] Louis considers to be due to a number of different causes. That there is more than one kind of rustiness seems certain, and we are warranted in classing allotropism among its causes. It has long been well known that rusty gold is indifferent to mercury, and that it is often the cause of great losses in mining and metallurgical operations; hence the question is of large practical importance. I have been recently examining microscopically some rusty gold collected from the placers of the Cauca valley, Colombia, South America. I have found in this instance that the rustiness appears to be of two kinds, a black stain on some of the particles of gold, and upon others from the same deposit a dull reddish color. When treated with hydrochloric acid the black stains disappear immediately, whereas the dull reddish color is not appreciably affected by the acid, but sometimes completely detaches itself as a film from the gold particle and floats off in the solution. Under the microscope this exceedingly thin pellicle or skin looks like gold by reflected light, but by transmitted light it fails to give the characteristic greenish color peculiar to gold under such conditions, and it has a reddish color. Some of these gold-grains which I have examined are surrounded by a matrix of minute quartz particles cemented together and to the gold by iron oxide. In the great majority of instances the rust is undoubtedly due to iron oxide, and in tracing back to the deposits from which these particular gold-particles came, it was found that they are old bench-gravels undergoing considerable decomposition.

In wet, tropical countries the extent of rock decomposition in place is usually enormous, and results in thick accumulations of argillaceous and ferruginous residues, known variously as laterite, cascajo, *roche à ravets*, and saprolite.[9] The damp heat of the tropics, aided by decomposing vegetation, is a very powerful agent of alteration and of consequently chemical enrichment. According to Levat,[10] the *roche à ravets* of French Guiana often contains besides microscopic particles of gold, nuggets, often so completely covered with a ferruginous coating as to be taken for blocks of iron oxide. No one who has been practically engaged in mining in moist, tropical countries could fail to have noted the intensity of rock-decomposition where covered with forest or jungle; it exceeds as a rule any similar conditions to be found in temperate or frigid regions. Frost cannot play much part as an active disintegrating agent below a few feet in depth, and the effect of differences in temperature between day and night, a most potent agent in arid regions, is not appreciable at depths of even a few inches below the top soil. Hence it would seem that to organic acids from the moist, over-lying vegetation we must ascribe the energetic corrosive action upon rocks so evident in tropical countries. This force is naturally active upon gravel deposits and its decomposing, disintegrating power is relatively rapid and effective, breaking up the feldspars, dissolving the iron, reducing the ferric to ferrous sulphate, which must have some precipitating action upon any gold in solution. Later the ferrous salts are converted to ferric oxide, which is often found as a cementing and binding material in the manner aforesaid.

[7]"Zur Genesis der Metallseiften, Oesterr. Zeit. f. Berg. & Hüttenw., 1887, Vol. XXXV, p. 325. Also *Trans.* A. I. M. E., Vol. XXIII (1894), p. 337.

[8]Op. Cit., p. 186.

[9]Geo. F. Becker, 16 Ann. Rep., U. S. Geol. Sur., Part 3, p. 284. The word saprolite is used by Becker to signify a thoroughly decomposed rock in place. Laterite is a synonymous term, used in India, where it originated, but he objects to it on the ground that it also applies to transported material, and this is true. Just why the simple term 'decomposed country rock' is not good enough for the purpose he does not make clear; the interjection of new and unnecessary technical terms into scientific or pseudo-scientific literature should be avoided where plain English expressions will serve quite as well.—F. L. G.

[10]*Ann. des Mines*, Ser. 9, Vol. 13 (1898).

COMPANY REPORTS.

UTAH COPPER.

The report of the Utah Copper Co. on its operations at Bingham, Utah, for the first quarter of 1909 shows that as a result of inadequate transportation the tonnage mined and milled during January and February was below the capacity of the plants, and the earnings were correspondingly small. Transportation conditions improved materially in March, however, and the milling capacity of the plants was approached. The total tonnage for the quarter was approximately the same as that for the last quarter of 1908. The gross output of copper in concentrate produced was 12,107,549 lb., the excess over the last quarter being 330,885 lb. The cost per pound of copper was slightly higher, being 9.68c. per lb. of net copper produced after deduction of smelter allowances. The average net recovery at the mills improved nearly 5%. A better quality of ore was milled, with less oxidized copper minerals. The average copper content was somewhat lower, so that the net pounds recovered per ton were only slightly greater.

The net profit from mining and milling operations for the quarter amounted to $375,894. The additional income amounted to $6574. The total net profit for the quarter was $382,469. The average price of copper was 12.82c. per pound, less by nearly 1.3c. than for the previous quarter. At the expiration of the period sales of copper had been made covering the output available for delivery well into the month of April, and no stock of finished copper was carried over.

March was the first month in which the total capacity of the plants was approached. More than half the earnings for the entire quarter were made in the one month, on the basis of 12½c. copper.

The tonnage for the month of April, so far, has been somewhat above the rated capacity of the plants, and the output of copper for the month will be considerably in excess of the output for the month of March, which was over 5,000,000 lb. Should this condition continue throughout the second quarter, the earnings should be nearly if not quite double those of the first quarter, at the same prices. The ore treated during the first quarter was 21½% from underground and 78½ from steam-shovels. During the quarter an additional steam-shovel was put into commission on stripping. Nearly 95,000 cu. yd. of capping was moved monthly. During March the removal of capping amounted to over 111,000 cubic yards.

BROKEN HILL PROPRIETARY.

The report of the Broken Hill Proprietary Co. on operations at their mines in New South Wales, for the half-year ending November 30, 1908, shows, despite labor troubles, a net profit of £25,791, and liquid assets of £459,729. The production for the half-year amounted to 264,847 tons. The zinc concentration plant handled 135,235 tons, producing 29,659 tons of concentrate, assaying, zinc 44.09%, lead 9.60, silver 14.88 oz. Strong sulphuric acid to the amount of 2752 tons was made. The Port Pirie lead-smelting plant was operated continuously, handling 125,784 tons of ore, 5915 of dross, and 1280 of dust, producing 48,350 tons of bullion. The Huntington-Heberlein plant is reported to have done good work, the gas-firing giving every satisfaction. The Carmichael-Bradford plant handled 25,683 tons of concentrate. In the refinery 48,368 tons of bullion was handled, yielding 2,589,416 oz. silver, 1054 oz. gold, 47,833 tons soft and 470 antimonial lead. The first zinc distillation furnace was finished and tested. Nine more furnaces are being built.

CLOVERFIELD.

The Cloverfield Mines, Ltd., is the owner of 801 mining claims on the Rand, on the Cloverfield farm. The mine is now being re-opened, shaft-sinking having been resumed last September. The shaft was put down 103 ft., or to 1448 ft., by the end of 1908. S. C. Thomson is consulting engineer.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

PRINCIPLES OF MINING. By Herbert C. Hoover. 8vo., pp. 199, Ill. Hill Publishing Co., New York, 1909. Price $2.50.

This little volume discusses especially the valuation, organization, and administration of copper, gold, lead, silver, tin, and zinc mines. It is based upon lectures given at Stanford and Columbia Universities. It is written essentially from the point of view of mine valuation. As would be expected from the author's wide experience, it is replete with interesting and valuable data. While no claim is laid to great originality the book is extremely suggestive. Its scope is confessedly limited and much of it more applicable to "deposits of fissure vein type" than to those in which "metals occur like plums in a pudding." Problems of pumping, ventilation, haulage, and hoisting are only discussed in a general way, but with distinct reference to mine valuation. The details of opening up and equipping a mine, as given by Mr. Hoover, afford hints for the examining engineer, reminding him of the elements of the problem. This discussion, while occupying the greater bulk of the volume, is less vital than the opinions on mine valuation offered by a man of such wide experience in connection with properties where large responsibility has been involved. He calls attention to the risks in sampling which ensue from having no means for checking the work by assays made on the spot. Such assays are an invaluable safeguard, though no engineer would depend upon these alone as a basis for his report. Mr. Hoover also reminds us that ore sampled in place commonly gives higher results than subsequent mill-records will sustain. The truth of this statement engineers of experience will confirm. The author cites an example in South Africa where the assay-samples proved to have been too high by 20%. A factor of safety must manifestly be adopted, and Mr. Hoover proposes a minimum of 10% as an appropriate basis for discounting the results of sampling. Manifestly it will vary widely in different mines. His definition of ore according to the state of development of the mine is rational and worthy of universal acceptance. He recognizes four degrees of certainty: (1) positive ore, developed on four sides; (2) ore blocked out, developed on three sides; (3) probable ore, where two sides are exposed; and (4) possible ore, of which but the upper side is open to inspection. The great question of amortization of capital is handled in a manner to impress the reader with the necessity of making adequate provision for re-imbursing the investor, but the speculative features of mining are so strong, and the custom of over-valuation so persistent and universal, that in effect Mr. Hoover has recourse to the general average of success, in spite of insufficiency of demonstrated ore, as a basis for assuming what measure of precaution or of risk a man may take in this regard. He works out interesting and suggestive examples, but a lack of well crystallized advice is conspicuous in this chapter. His one definite declaration of conviction on the point consists in this: "Mining business is one where 7% above provision for capital return is an absolute minimum demanded by the risks inherent in mining." But in determining the purchase price which may be recommended, does Mr. Hoover insist upon seeing the whole of it in 'positive' and 'blocked' ore, or may part of it be assumed to lie in the 'probable' ore, or perchance even in the uncertain depths of 'possible' ore? He meets here the problem that men will not let the engineer solve. The successes following risks, though fewer than the failures, are so conspicuous that the capitalistic world would refuse to follow the engineer who would button him up in a straight-jacket of conservatism, and demand that the ore available for stoping should even possess a gross value equal to the amount of risk involved in its exploitation. The system of working out the value of shares or dividends, certain conditions being postulated, is simple enough, and the exposition given by Mr. Hoover is lucid and important. The great difficulty is in agreement upon what shall constitute the degree of safety required

for the initial investment. As a general law he declares that the speculative value of the 'good-will' in ordinary commerce is greater than in mining. This is probably true. The percentage of commercial failures is certainly greater than the percentage of mine-failures, if we eliminate the disappointments of the prospectors. After all it is a question of averages, a problem participating in the risk that inheres in life itself. But Mr. Hoover does not leave the reader 'in the air'. Without coming to conclusions in dogma, he argues by example and gives impressive illustrations of risks that are manifestly unwarrantable. Between these and theoretical certainty the capitalist and his engineer must elect what they shall consider the prudent mean in each specific case. The volume is the best exposition in existence of the methods by which the modern engineer proceeds to value mines; it represents the opinions of a man who speaks from the ground of vantage of having been himself a part in the conduct of great enterprises from the stage of early uncertainly to the maturity of large success.

MINERS' & SMELTERS' TELEGRAPH CODE. Adopted by The American Smelting & Refining Co. 8vo., pp. 464. The Business Code Co., New York, 1908. Price $12.

A leading merit of this code consists in its extremely systematic method for the development of a compact expression for a lengthy sentence. In actual use it admits of saying two or three times as much as is possible with other codes in the same number of words. The code-words are to a considerable extent built up by union of so-called phrase-words. Each code-word consists of 5 letters, which are mere combinations of letters arranged in alphabetic order. They do not make true words in any language, but are mere symbols. There is no chance of confusion of one code-word with another, since the phrase unit consists always of the same number of letters. For economy two such units may be joined in transmission. The defect of the system is that the telegraphic operator has no rational basis to assist in correct transmission, and errors arise more frequently than with other ciphers. Its advantages in other respects, however, outweigh this difficulty.

REPORT ON THE EXAMINATION OF SOME IRON ORE DEPOSITS IN THE DISTRICTS OF THUNDER BAY AND RAINY RIVER, PROVINCE OF ONTARIO. By F. Hille. Canadian Department of Mines, Mines Branch. 8vo., pp. 65, Ill. Ottawa, 1908.

INVESTIGATIONS OF THE COALFIELDS OF COLORADO, NEW MEXICO, UTAH, OREGON, AND VIRGINIA IN 1907. By H. S. Gale and others. Bull. No. 341-C, U. S. Geol. Survey. 1909.

CONCRETE-STEEL CAISONS. Their Development and use for Breakwater, Piers, and Revetments. By W. V. Judson. Jour. West. Soc. Eng., advance sheets, pp. 70.

PROGRESS OF THE MINERAL INDUSTRY OF TASMANIA. For the quarter ending December 31, 1908. Compiled by W. H. Wallace. 8vo., pp. 13. Tasmania, 1909.

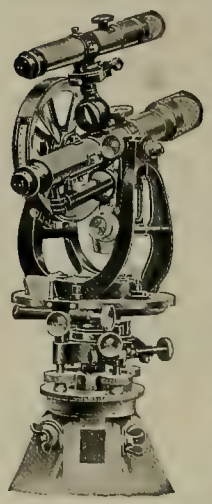
STATE GEOLOGICAL AND NATURAL HISTORY SURVEY OF CONNECTICUT. Third Biennial Report of the Commissioners. 8vo., pp. 30. Hartford, 1908.

SUMMARY REPORT, GEOLOGICAL SURVEY BRANCH, DEPARTMENT OF MINES. For the year 1908. 8vo., pp. 220. Ottawa, 1909.

IT IS interesting to note that turbines have been adopted in the plant of the PORTLAND CEMENT CO., at Portland, Colo., for power extension, rather than Corliss engines, two of which have already been operating for a number of years on surface condensers. The fuel used is a southern Colorado bituminous coal of rather poor quality. With the moderate superheat and high vacuum contemplated, it will be possible for the turbine to effect considerable economy in operation. Although direct current is largely used at this plant, an alternating current turbine unit was selected in connection with a rotary converter as providing greater flexibility of operation than obtainable with a direct-current turbine unit which was also under consideration.

New Mining Theodolite.

The accompanying engraving illustrates a new theodolite adapted to mountain and mining work. It has a 4½-in. limb and vertical circle with edge graduation, 8-in. 20-power main telescope, 7-in. 18-power auxiliary telescope (with counterweight) that may be used either as a top or side telescope, 4-in. 30-second telescope level, stadia, gradienter, magnetic variation circle, 4-screw leveling head and extension tripod. The instrument weighs 9 lb. complete with all attachments. It is made of hard bronze alloys, and a 2¼-in. compass for checking is fixed in the centre. The limb verniers are placed at 30° with the line of sight, which, together with the edge gradation on the vertical circle, enables an operator to read both vertical and horizontal angles from the one position. The telescope tubes are so finished as to insure perfect collimation for all distances. High-grade lenses are used. The telescope axis has the usual grooved bearings common to all this firm's instruments.



The leveling head is of improved design, constructed so that it cannot be cramped in any position. This greatly reduces the wear on the leveling screws and renders it unnecessary to loosen all of the screws when leveling up. The shifting centre has a movement of ½ inch to permit placing plumb-bob over point. The graduations, with the exception of the compass circle, are on solid silver. They are produced on the new 30-in. automatic dividing engine belonging to the makers, Wm. Ainsworth & Sons of Denver. This machine, it is claimed, can produce automatically circles accurate to within one second of arc. The instrument is described in their catalogue BX9 just issued.

Catalogues Received.

THE DENVER FIRE CLAY CO., Denver, has just issued a bulletin describing its Ller disc pulverizer, a new machine of the oscillating type.

The SULLIVAN MACHINERY CO., Chicago, has just published an attractive little booklet describing the different types of Sullivan machines.

The JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J., is distributing a small booklet giving information regarding its line of graphite products.

The AMERICAN ELECTRIC FURNACE CO., New York, has recently published a bulletin descriptive of the Rochling-Rohenhauser and ordinary induction furnaces.

FAIRBANKS, MORSE & CO. have just issued a general catalogue covering the complete line of goods carried by that concern. There is included much that is of interest to mining men.

Commercial Paragraphs.

ALBERT W. MCINTIRE has opened law offices at Suite 23-26 Haller Bdg., Seattle, and will devote special attention, for Washington and Alaska, to all phases of mining law.

WALTER B. SNOW, of Boston, Massachusetts, announces the association with his staff of Carl S. Dow, recently publicity manager for B. F. Sturtevant Co., and formerly in charge of instruction and text-book departments, American School of Correspondence.

DWIGHT T. RANDALL, recently engineer in charge of fuel tests, Technologic Branch, U. S. Geological Survey, has associated himself with ARTHUR D. LITTLE, Laboratory of Engineering Chemistry of Boston, in charge of the department of fuel engineering. Mr. Randall was formerly connected with R. W. Hunt & Co. and Westinghouse, Church, Kerr & Co., and later in charge of the steam engineering laboratory of the University of Illinois and of steam and boiler tests at the St. Louis exposition.

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EDITORIAL.

THE THERMOMETER promises to pass the tariff bill immediately.

PREDICTION of higher rates on call loans has been justified already. Money is moving more freely into industrial development, and interest is rising rapidly.

TRAVEL to Alaska is heavy now. The *Corwin* reached Nome May 28, maintaining her record of being first to arrive. The steamers sailing the last of this week are crowded, many having stayed over to see the opening of the Exposition at Seattle, in which Alaskans have large interest.

FROM CANADA comes a new nomenclature. Time-honored custom had recognized a division of metals into 'noble' and 'base' or 'precious' and 'common'. The terms 'superior' and 'inferior', as now used in Ontario law, have something to commend them.

MATERIAL for a new romance is being gathered in the Montreal River district of Ontario by Mr. Julian Hawthorne. These romantic operations are being conducted systematically by the syndicate method. The first novel issued was the Temagami-Cobalt Mines; others in press are the Elk Lake Mines, and the Montreal James, Limited. There is also material available for a farce, which will undoubtedly be later exploited.

LABOR UNIONS have often shown disregard for economic principles. The United Mine Workers of America, however, have decided to accept Asiatics into full membership, and have sent organizers into Western Canada to bring the Japanese into line. This is done frankly on the basis of necessity. If the Japanese are not admitted the organization can not expect to control the labor situation in the coal mines of British Columbia and Alberta, any more than it could have in the East and South without admitting 'hunkies' and negroes. Thus economic principles triumph over race prejudice.

COLUMBIA UNIVERSITY has, this week, conferred honorary degrees upon two well known men connected with the mining industry. Mr. Benjamin B. Lawrence is an alumnus of the School of Mines and was recently elected a trustee of the University which has now conferred upon him the degree of Master of Science. His friends in Colorado, and elsewhere, will be glad that this member of the mining profession has been thus distinguished by his alma mater. Mr. S. F. Emmons was made a Doctor of Science, and thereby Columbia University honors a graduate of Harvard whose whole career exemplifies a devotion to science as consistent as it

has been useful. No man living has done greater service in the application of geology to mining, and it is not too much to say that throughout the West the news of the latest honor done to the expositor of Leadville will be received with keen pleasure.

PERMITTED explosives only are used abroad in coal mines, and to obtain a permit an explosive must meet certain government tests. A similar system is about to be adopted here by co-operation of the powder-makers and the Government. Some thirty powders, manufactured for use in coal mining were sometime since submitted for trial at the Geological Survey testing plant at Pittsburg. These included samples from both the 'Trust' and 'Independent' makers, and the tests were agreed on in advance. Each sample required about one hundred and forty individual tests, besides numerous analyses. It now develops that only seventeen of the thirty explosives tried, stood the test. This demonstrates, if anything, the need and the usefulness of some such system of testing and marking powders. Not long ago a powder which had been issued to miners in a certain coal mine, was tested and found to contain less than six per cent of grains of the size marked on the package. As size largely controls the speed of burning, we have in this misbranding a sufficient cause for many accidents. In determining the proper character of powders for mine use, and in certifying to the quality of those on the market, the Technological Branch of the Geological Survey is doing part of the work which would be expected of a Bureau of Mines. We are particularly glad to see this done with the co-operation of the manufacturers.

EARTHQUAKES are confined to no particular part of the country, as is witnessed by the shock felt at Chicago May 27. This five-second quake did no particular damage, but reminded the inhabitants of Iowa, Wisconsin, Michigan, Missouri, and Illinois of the power of subterranean forces. The last preceding shock of any importance in this region occurred October 31, 1895. The greatest earthquake the Mississippi Valley is known to have suffered was in 1811. Earth tremblings occurred at intervals for two years, and would have been exceedingly destructive if the country had then been densely settled. As it was, the Mississippi was temporarily reversed and many important physiographic changes occurred. Among the lakes then formed was Reelfoot, in Tennessee, recently made famous by White Cap outrages in its vicinity, and by the notable and refreshing manner in which the majesty of the law was vindicated by an able executive. Other lakes and topographic marks show that this, the New Madrid earthquake, was one of the most notable in historic times, all of which is substantiated by contemporary accounts. The shock of last week was not important. A few chimneys were toppled over, a few small fires were started, a quiescent artesian well in Lincoln Park was set spouting, and the inhabitants of our second city were given a new sensation—something hard to give a Chicago man. We note that Chicago is duly grateful, and regards the incident with half-pleased interest. Earthquakes are among the risks of life. They can not be prevented, and can only be dimly foretold, but they may be met with that cheerful courage which is after all one of our greatest national assets.

Valuation of Coal Land.

Valuation of coal land is not easy; not because it is difficult to estimate the amount of coal in the ground, nor even because of difficulties in fixing the probable selling price. Both can be determined more easily and usually more accurately than in the case of mines of other minerals. The unknown element is the interest-charge accruing before the coal is sold. Where there is a surplus of coal-land it is clear that only a portion of the coal can be marketed at any one time, and in the case of large holdings it is years before all can be sold. Against the future selling price must be offset the accumulated interest-charge on the present purchase-price. Practically, coal-land in the United States, while affording one of the safest investments for people having no desire for prompt returns on their money, is of no immediate value except to the relatively limited extent required to satisfy present market requirements. This has been proved by repeated failure of attempts to make the output of a few mines carry the interest-charge on large holdings. Land is valuable for the coal that is in it only in proportion to the market the owner is able to command.

Such considerations, among others, were doubtless influential in determining the early policy of the Land Office in the matter of sale of coal-lands. These were regularly sold at the minimum price—the nominal sums of $10 and $20 per acre. Even at this they were the highest priced Government lands. In general the attitude of the Government was that the increment of value resulting from the settlement of the western country should go to the people who put their money into the West. While this resulted frequently in the enrichment of speculators, it also, in a large way, helped the West and therefore helped the country as a whole.

Prices of the coal-lands of the public domain are now being raised. As pointed out in our Washington correspondence last week, the lands in a particular township in Wyoming that formerly would have been valued at $460,000 are now held at $2,800,000. Such an increase in valuation, even though it still amounts to only 12 per cent of the value of the land on a present royalty basis, can produce but one result—the lands will only be sold as they are actually needed for mining purposes. This should reduce the danger of monopoly, without promoting over-production and wasteful competition. In the end it should give future generations cheaper coal. The unearned increment will go in part to the nation rather than to individuals. All this is good, but to complete the plan the law should be changed so that individuals and companies may honestly acquire holdings of the size demanded by modern operations. This was recommended by Mr. R. A. Ballinger when Commissioner of the Land Office, and now that he is Secretary of the Interior it will doubtless be further urged. Another point which seems to us equally im-

portant is that provision be made for a special portion of the increment to go to the State or county in which the land is situated. The increase in value comes from the growth in the country at large, it is true, but in a special way the actual settlers deserve a share in whatever augmentation comes from the development of their immediate district.

Nickel, a Canadian Monopoly.

Toronto despatches announce that the Ontario legislature is cogitating a renewed attack upon the nickel industry. We fully sympathize with the desire to benefit the Province by refining the Sudbury matte at home, but prohibition of exportation of any commodity is a limitation of the market, and amounts to coercion. The consumption of nickel in naval construction is the basis of the industry. England needs nickel for her Dreadnaughts, and might have used a great deal more than she has but for Mr. Asquith's somnolence. Germany has been buying plenty of nickel in the open market, as Mr. Asquith should have done. The Kaiser stole a march on the British in laying down warships so fast that the only way to catch up with her naval program would in truth be to hamper her in obtaining necessary supplies. That Ontario has furnished munitions of war to the menacing Teuton is now being made a patriotic pretext for squeezing the Sudbury miners. The appeal to loyalty is sure of lusty applause; when it was a question of making business for more Canadians it was open to discussion; economic problems are instruments for jugglers on both sides of the midway, and the public generally passes on in a state of bewilderment; but there is no argument required when appeal is made for defense of the flag; the only thing possible is to wash down grim determination in copious drafts of MacLaren's 'malt', and shut off the dreadful German from buying nickel, with shouts of "God save the King." This would be well enough were it actually possible to injure the belligerent foreigner by such restrictions, but there are other deposits in the world than those of Sudbury, and nothing will cause their development more speedily than to withhold Canadian competition. The reason for the present monopoly of the Ontario nickel producers is purely commercial, which is a fact apparently overlooked by the Ontario politicians. Another point which has evidently been overlooked consists in the delicate position in which Great Britain and Canada would find themselves should Germany choose to retaliate by prohibiting the export of potash. The peril from a suppression of this trade is such that the late Edward Atkinson and a group of philanthropic gentlemen in Boston subscribed capital for a potash-hunt, from purely patriotic motives. The search ended in failure, and the fact is that Germany produces all of that vitally necessary substance which is used in Great Britain, in Canada, and in the United States today, and there is no other source for a sufficient supply. We have no quarrel with Ontario in her desire to compel the refining of nickel within her borders. That is a matter of business, and if the effort should demonstrate that it only stimulated rivals, Ontario would promptly recede from her position. But to prohibit exportation on the plea of protecting the Mother Country would be in effect an expropriation of the property of men who were invited by liberal laws to invest capital which has enriched the Dominion and at the same time, properly enough, the men who developed the nickel industry. It would limit them to a restricted market, and the Admiralty could elect what price the producers should receive. The Ontario Government has committed numerous follies in its administration of mineral resources; restriction of the nickel industry would be the crowning absurdity.

Mining Claims on Private Land Grants.

In the first session of the last Congress a bill was introduced into the House by Delegate William H. Andrews of New Mexico, permitting the location, according to the Federal mining laws, of claims to gold, silver, and quicksilver deposits on grants confirmed by the Court of Private Land Claims. The purport of this bill has excited interest and speculation. Many have thought it masked a blow at the Railroad land grants, and others have averred that it threatened lands held under title flowing from early Spanish and Mexican concessions, wherever situated. The bill is, in fact, only one of a crop of recurrent efforts at legislation which spring up at each Congressional session. It has nothing to do with the railroad lands. Those are covered by title issued under authority of Acts of Congress, and carry absolute possession. Whatever may have been the intention of Congress when conceding those princely subventions, the issuance of patent carries with it a final determination of the character of the land. Furthermore, a large number of the old Mexican grants has been placed beyond the reach of further legislation. The California grants have been confirmed under Congressional enactment which created a special Board of Land Commissioners for that purpose, whose action was subsequently passed upon by the Federal Courts, and patents issued thereon without reservation. In construing these patents Mr. Justice Stephen J. Field, speaking for the Supreme Court of California in the so-called Mariposa case (Frement *v.* Flower, 17 Cal. 199, 79 Am. Dec. 123), affirmed the principle that patents issued under such circumstances carried the minerals.

This decision was in accordance with the Common Law of England, adopted as fundamental in this country. The Mexican grants were not patents, and on the cession of territory to the United States the title necessarily passed to the Government, which was bound to respect the rights of those who held grants under authority of Mexico. These were subject to the limitations of the Roman law, which establishes the right to mines as inalienable from the sovereign power unless specifically conveyed. Yet it was held in California that patents issued by the United States confirming ownership in such lands were not limited by the principles of the Roman law, since the passing of title required that it should be in accord with the principles governing these matters under our own legal system.

The question was, however, re-opened by the case

of the United States *v.* San Pedro & Canyon del Agua Co. (4 N. M. 225, 17 Pac. 337), where the right to minerals was ultimately denied by the United States Supreme Court (146 U. S. 120, 13 Sup. Ct. Rep. 94), unless specifically conceded by the terms of the grant. The validity of right to mines on such a grant was not decided, but the inference was unavoidable that tenure was at least open to question.

In 1891 an Act of Congress was passed creating a Court of Private Land Claims having jurisdiction over Mexican grants in Colorado, Wyoming, Utah, Nevada, New Mexico, and Arizona. This act introduced a consideration of title at variance with the decision previously reached in regard to the grants in California. It stated, in part:

"No allowance or confirmation of any claim shall confer any right or title to any gold or silver or quicksilver mines or minerals of the same, unless the grant claimed effected the donation or sale of such mines or minerals to the grantee, or unless the grantee has become otherwise entitled thereto in law or equity; but all such mines and minerals shall remain the property of the United States, with the right of working the same, which fact shall be stated in all patents issued under this act. But no such mines shall be worked on any property confirmed by this act without the consent of the owner of such property, until specially authorized thereto by an act of Congress hereafter passed."

Thus it appears that the bill presented by Mr. Andrews is only one of the annual answers to the call for further legislation sounded in the closing sentence of the section above quoted. The statute now on the books does not throw open adjudicated grants to prospectors, even where the Court has found that mineral rights were not conceded originally. The right to prospect and to locate mineral claims exists only on public lands. Such adjudicated grants are not public lands, and hence special legislation is required to permit the utilization of mineral deposits on such areas. The bill presented by Mr. Andrews purports to cut the Gordian knot, but the situation is full of difficulties and perplexities. It is still required to determine the fact of conveyance or reservation of the mineral rights by the original title where the grants have not been adjudicated, and regard is due to rights acquired by the owner in law or equity. Thus the tenure of the new locator is subject to court decree, as under the statute of 1891. In the case of the Maxwell grant, the owners have made private regulations under which prospectors may search for minerals and acquire rights, subject to certain regulations which are definite. This is a sensible procedure, and the plan might be advantageously adopted by owners of grants where the titles have not yet been passed upon. Concessions under royalty, applicable without invidious distinction to all comers, would be better than the present doubtful status under the law. Custom is as good as law, and in the case of hard problems such as this, where the conflicting interests are so strong as to keep the controversy from legislative determination, the development of an equitable and honorable usage is more desirable than controversy.

BY THE WAY.

Following is a portion of the address recently made by Rudyard Kipling before the students of McGill University, Montreal:

When, to use a detestable phrase, you go out into the battle of life you will be confronted by an organized conspiracy which will try to make you believe that the world is governed by the idea of wealth for wealth's sake, and that all means which lead to the requisition of that wealth are at least expedient.

Now, I do not ask you not to be carried away by the first rush of the great game of life. That is expecting you to be more than human. But I do ask, after the first heat of the game, that you draw breath and watch your fellows for awhile. Sooner or later you will see some man to whom the idea of wealth as mere wealth does not appeal, whom the methods of amassing that wealth do not interest, and who will not accept money if you offer it to him at a certain price.

I would like you to study that man. I would like you better to be that man, because from the lower point of view it doesn't pay to be obsessed by the desire of wealth for wealth's sake. If more wealth is necessary to you, for purposes not your own, use your left hand to acquire it, but keep your right hand for your proper work in life. If you employ both arms in that game you will be in danger of stooping; in danger also of losing your soul. But in spite of everything you may succeed, you may be successful, you may acquire enormous wealth, in which case I warn you that you stand in grave danger of being spoken and written of and pointed out as a smart man. And that is one of the most terrible calamities that can overtake a sane, civilized white man in our empire today.

They say youth is the season of hope, ambition, and uplift—that the last word youth needs is an exhortation to be cheerful. Some of you here know, and I remember, that youth can be a season of great depression, despondencies, doubts, and waverings, the worse because they seem to be peculiar to ourselves and incommunicable to our fellows.

I know of what I speak. This is due to a variety of causes, the chief of which is the egotism of the human animal itself. But I can tell you for your comfort that the chief cure for it is to interest yourself, to lose yourself, in some issue not personal to yourself—in another man's trouble or, preferably, another man's joy. But if the dark hour does not vanish, as sometimes it doesn't; if the black will not lift, as sometimes it will not; let me tell you again for your comfort that there are many liars in the world, but there are no liars like our own sensations. The despair and the horror mean nothing, because there is for you nothing irremediable, nothing ineffaceable, nothing irrecoverable in anything you may have said or thought or done. If for any reason you cannot believe or have not been taught to believe in the infinite mercy of Heaven, which has made us all, and will take care we do not go far astray, at least believe that you are not yet sufficiently important to be taken too seriously by the powers above us or beneath us.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. H. MACKENZIE is at New York.

REGIS CHAUVENET is at Ely, Nevada.

THOMAS G. LOCKHART has been in Denver.

ARTHUR SHUTTS has gone to Nome, Alaska.

A. D. HODGES, Jr., has been in San Francisco.

W. H. SIRDEVAN has just left for Nome, Alaska.

EDWARD L. DUFOURCQ has been in San Francisco.

JOHN C. BRENNON, of Mexico City, is in New York.

WHITMAN SYMMES was in San Francisco this week.

DOUGLAS WATERMAN has gone to La Union, Salvador.

W. C. WYNKOOP has returned from Plumas county, California.

STEPHEN BIRCH is on his way to the Copper River district, Alaska.

J. A. BARR is examining mines in the Golconda district, Montana.

HENRY BRATNOBER expects to go to Nome, Alaska, at an early date.

H. C. BEELER has gone to Hailey, Idaho, to reconstruct the Croesus mill.

H. L. THOMPSON was in San Francisco, on his way to Seattle.

C. O. MOSS is manager for the Kansas City-Goldfield Mining Company.

ELWYN W. STEBBINS has returned to San Francisco from Oaxaca, Mexico.

WM. M. BREWER, who has been in the hospital at Vancouver, is convalescent.

FREDERIC LYON, assistant manager for the U. S. S., R. & M. Co., is in San Francisco.

A. H. ELFTMAN has been in San Francisco, on his way to Nevada City, California.

PERCY E. BARBOUR has returned from Alamos, Mexico, and is now in San Francisco.

VICTOR E. KERR is manager for the Gold King Con. Mines, near Gladstone, Colorado.

GEORGE D. STONESTREET is at Salt Lake, but expects to return to New York shortly.

WM. H. RADFORD has gone to examine the platinum placers of the Condoto river, Colombia.

THOS. T. READ, of Tientsin, will visit mines in Japan, Korea, and East Siberia this summer.

VICTOR RAKOWSKY has gone to the Cascade mountains, and from there will go to Butte, Montana.

J. O. CAMPBELL has been appointed receiver for the Gold Prince mine, at Animas Forks, Colorado.

J. J. SPEAK, of Hooper & Speak, has left London for West Africa, where the firm has mining interests.

WALTER W. BRADLEY has accepted a position with the De Lamar Mining Co., Ltd., at De Lamar, Idaho.

E. W. BROOKS, of Los Angeles, will sail from Seattle shortly for Alaska, to examine copper properties.

M. R. CAMPBELL and E. W. PARKER, of the U. S. Geological Survey, are examining the Stone Canyon coalfield.

A. E. DRUCKER is at the Waihi mine, in New Zealand, having just visited West Australia and New South Wales.

H. C. CUTLER, managing engineer for Nixon & Wingfield, resigned on the dissolution of that partnership, and has resumed general practice at Goldfield.

E. W. DURFEE has resigned as general superintendent for the Daly Judge Mining Co., to accept the position of general manager for the Alvarado Gold Mining Co., Congress Junction, Arizona. He will make his home in Los Angeles.

THE SCHOOL OF MINES of South Dakota celebrated its twenty-second annual commencement June 2.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, June 3.

Antimony	12–12¾c	Quicksilver (flask)	44–45
Electrolytic Copper	15¼–16¼c	Spelter	6½–7¼c
Pig Lead	4.60–5.55c	Tin	32–33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 27. £ s. d.	June 3. £ s. d.
Camp Bird	1 2 0	1 2 3
El Oro	1 6 3	1 6 3
Esperanza	2 19 0	2 18 9
Dolores	1 10 0	1 10
Oroville Dredging	0 13 9	0 13
Mexico Mines	5 10 0	5 12 0
Tomboy	1 2 6	1 1 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 28	13.19	4.33	5.24	52⅞
" 29	13.19	4.35	5.25	53
" 30	Sunday.	No market		
" 31	Holiday.	No market		
June 1	13.19	4.35	5.25	53
" 2	13.25	4.35	5.25	52⅞
" 3	13.25	4.35	5.25	52¾

MINING QUOTATIONS—NEW YORK.

	Closing Prices. May 27.	June 3.
Amalgamated Copper	85	87⅛
American Smelting & Refining Co	93¾	96¼
Boston Copper	15½	15¾
Butte Coalition	26½	26½
Cumberland-Ely	8 5/16	8¾
Dolores	5¼	5
El Rayo	2	2
Giroux	7⅛	7⅝
Greene-Cananea	10⅜	10¾
Indiana Sonora	3	3
La Rose	7 9/16	7½
Miami Copper	14⅞	14⅞
Nevada Consolidated	22⅞	22⅞
Newhouse	2⅝	2¼
Nipissing	10⅞	10¾
Ohio Copper	5⅝	4⅛
Tennessee Copper	41	42
Utah Copper	51⅜	52
Yukon	5 1/16	5

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. June 3.		Closing Prices. June 3.
Adventure	8⅜	Mohawk	66
Allouez	40	North Butte	55½
Arcadian	5	Old Dominion	54½
Atlantic	9	Osceola	135
Calumet & Arizona	103½	Parrot	35¾
Calumet & Hecla	660	Santa Fe	2½
Centennial	32	Shannon	16
Copper Range	82¼	Superior & Pittsburg	14
Daly-West	7½	Tamarack	72
Franklin	16⅜	Trinity	13
Granby	104	United Copper Con	8⅜
Greene-Cananea, ctf	10⅞	Utah Con	42½
Isle Royale	28⅜	Victoria	5
La Salle	14	Winona	5½
Mass	9¾	Wolverine	148

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, June 3.

Atlanta	$ 15	Mayflower	$ 9
Belmont	84	Midway	24
Booth	15	Montana Tonopah	72
Columbia Mtn	11	Nevada Hills	1.20
Combination Fraction	75	Ophir (Comstock)	1.25
Daisy	33	Pittsburg Silver Peak	50
Fairview Eagle	20	Rawhide Coalition	29
Florence	3.17	Rawhide Queen	30
Goldfield Con	7.75	Round Mountain	77
Gold Kewenas	13	Sandstorm	10
Great Bend	9	Silver Pick	15
Jim Butler	14	St. Ives	11
Jumbo Extension	13	Tonopah Extension	55
Llanos Con	75	Tonopah of Nevada	7.00
MacNamara	24	West End	27

General Mining News.

ARIZONA.

COCHISE COUNTY.

The Copper Queen smelter at Douglas has blown in two new blast-furnaces with a daily capacity of 500 tons each. This makes a total of ten furnaces in this plant, to handle the ores of the Warren district and the concentrate of the Moctezuma Copper Co. of Nacozari.——The Calumet & Arizona is working at three points. Ore is being hoisted through the Oliver and Mag shafts, while at the Powell the work is purely development. The first station will be cut in the Powell shaft at the 600-ft. level, and from this point cross-cutting toward the Shattuck property and in the opposite direction will begin.——The Superior & Pittsburg's working shafts are now the Cole, Junction, and Hoatson. All are producing ore sufficient for a monthly copper output of 2,300,000 lb.——From the No. 3 shaft, the property of the original Lake Superior & Pittsburg Co., in the vicinity of Don Luis, considerable good ore is now being taken from the surface workings. This old shaft is connected with the 100-ft. level of the Cole shaft.——The Shattuck continues its work of developing the orebody on the 600-ft. level. Its extent is yet unknown, but it has been cut for more than 200 ft.——At the Denn exploration work continues on the 1250-ft. level. A cross-cut is now being run in the direction of the Junction which will soon reach the point corresponding with the location of ore encountered at the 1000 and 1100-ft. levels in this property.——A vein carrying copper, lead, and silver has been cut on the Doran & Gallagher property at Paradise.

MOHAVE COUNTY.

A force of miners has been sent out from Kingman to the Hackberry mines, as work on that property has been resumed.——J. A. Hamme is sinking on his mines in the Walnut Creek district, having the shaft down 75 ft.——E. J. McNulty, superintendent of the Aztec Turquoise Mining Co. at Mineral Park reports that there is enough turquoise in sight and around the Park to supply the demand for years. The mineral occurs in irregular streaks throughout the great mass of porphyry which forms the southern entrance to the basin.——F. B. F. Rhodes, representing the United States Zinc Co. of Pueblo, Colorado, went out to the Golconda mine in company with the general manager, John Boyle, Jr. Mr. Rhodes is purchasing low-grade mine products for his plant, which is intended to treat ores that can not be handled in the smelters.——The three-compartment shaft on the Enterprise mine, in the Wallapai mountains, is being sunk from the 200-ft. to the 400-ft. level. At this point a cross-cut will be run to the vein, which was 25 ft. wide at the 200. W. J. Martin is superintendent.

PIMA COUNTY.

Ore shipments from the Twin Buttes mine to the El Paso smelter amount to 400 tons per week. William McDermott is superintendent.

PINAL COUNTY.

F. S. Hoyt, manager for the Superstition Mountain Mining Co., has purchased a large concentrating plant that was installed in the Cave Creek district but never used, and will move it to the company's mines, situated in the Superstition mountains, about 45 miles north of Florence, as soon as the wagon road now in course of construction from Hewett station to the mines is completed.

YUMA COUNTY.

Barney Quinn, of Winchester, sold the Sitting Bull mine to J. D. Mitchell, of Salt Lake, and A. Mathews, of Marquette, who are representing Eastern capitalists.——Arthur G. Munn's claims near the Colorado river between Needles and Parker have been acquired by the California Nitrate Company.

Shaft No. 1 of the Hillside Mining Co., at Salome, is now down about 25 ft. The vein on the surface was only 15 in. wide, but has now increased to 5 ft., a sample of which assayed $8 per ton. About 600 ft. from this shaft the company has begun driving an adit to cross three veins that are exposed on the surface.

CALIFORNIA.

AMADOR COUNTY.

(Special Correspondence).—The miners' strike has been settled on terms satisfactory to the operators, and practically all the properties are again working full-handed.——The main shaft at the Bunker Hill has attained a depth of 2200 ft., and drifts are being extended from the 1750 and 1950-ft. stations to strike the vein. This property has paid dividends steadily for four years. Twenty stamps are dropping and 20 more will be installed. E. H. Harrington is superintendent.——At the South Eureka extensive operations are going on from the 2300 to the 2750-ft. levels. About 6000 tons of fair-grade ore is handled per month. Half of this is treated at the 20-stamp mill on the ground, the rest at the Central Eureka mill. B. C. Clark is manager.——At the Fremont Consolidated ore is being mined to the 1500-ft. level and treated in the 40-stamp mill.——Arrangements are being made at the Original Amador for the erection of a 20-stamp mill. A large reserve of milling ore has been opened in the mine.——Operations at the Keystone are progressing steadily. The property is equipped with a 60-stamp mill, a large electric compressor, and steam hoist.——About 150 men are working at the Kennedy. The work of sinking the 3500-ft. shaft deeper is progressing steadily. The mill is running at full capacity.

Jackson, May 29.

INYO COUNTY.

(Special Correspondence.)—At the Cerro Gordo extensive developments are going on around the 1000-ft. level, and steady shipments of ore are being maintained to the Keeler smelter. The company is busily arranging for the projected enlargement of the Keeler plant, and it is thought that active work will shortly commence.——The unwatering of the Tower mine is progressing.——Information from Greenwater indicates that the orebody recently opened at the Greenwater-Death Valley mine is too low-grade for commercial purposes. The ore was cut on the 1000-ft. level and the shaft will be sent down 500 ft. deeper, in the hope of the grade improving with depth. If this fails it is reported that an effort will be made to secure properties elsewhere in order to reimburse the stockholders. With the exception of the Greenwater-Death Valley, no properties are now working at Greenwater. The district has been practically abandoned, the gold as well as copper propositions failing to come up to expectations.

Bishop, May 29.

NEVADA COUNTY.

The Fairview mine, near Washington, opened a $7000 pocket in a raise. The mine is being opened through an adit that was driven 900 ft. to cut the vein. Drifts were run along the vein 160 ft. and a raise started to the surface for an air shaft. When up 200 ft. this broke into the pocket. The ore carries considerable manganese and averages about $17 per ton gold.——At the Red Ledge mine, two miles south of Washington a bunch of rich ore was found in a cut just below the tunnel. The pocket was uncovered at a depth of 3 ft. An adit will be started lower to give a depth of 150 ft. on the vein. The mine is owner by Foster Williamson and Clyde Cole. It is composed of five claims, and a surface sampling of the vein has shown more than $2 of free-milling gold.——L. W. Williams and associates have been prospecting a small vein of galena ore in the vicinity of the Mason ranch, about 12 miles from Grass Valley. A shaft is down 24 ft., from which a cross-cut has been driven 18 ft. Samples of ore taken from these workings gave an average assay value of 6% lead and $3.50 per ton in gold.——At the Montana mine, in the Nevada City district, a number of improvements have recently been completed. A new shaft-house has been erected, a hoist of sufficint capacity to sink to a depth of 1000 ft., and a Sullivan air-compressor of 3-drill capacity installed. A Pelton wheel furnishes the power. During the past month some good ore has been cut, and the manager, W. G. Drown, reports the outlook bright, and the results recently obtained has fully

justified the work done, and the work of prospecting and developing the mine will continue with a force of 14 men. ——The shaft at the Pittsburg has been unwatered to the 300-ft. level. The mill is being overhauled. Mark B. Kerr is superintendent.——The Hill mine has been closed down and the pumps taken out by the lessees. The vein encountered near the surface failed to persist with depth.——Two new plunger pumps are being installed at the Empire, and soon after they have been placed in commission the work of sinking the shaft will commence; the 40-stamp mill is running constantly on good ore.——Active development continues below the 4500-ft. level at the North Star mines. The 6-ft. main vein is showing up well and 80 stamps are dropping.——Operations have been resumed at the Kenosha and the shaft is going down steadily. George W. Root is manager.

SIERRA COUNTY.

Three claims at Alleghany owned by Wm. Ireland, Jr., have been bonded by C. C. Ward. The claims are on Kanaka creek, and are all patented.——The Cleveland mine, near Sierra City, has been bonded by Charles Brown of Forest.——The Omega gravel mill, near Forest, is to be started the early part of this month. Considerable outside work is being done, and in the mine the gravel is broken ready for the mill.——The dumps and flumes are being put in repair at the White Bear mine; gravel chutes put in underground and preparations made to wash the gravel recently uncovered.——Work has been started on the Blue Jay group of claims by W. A. Lotspeich, who has a bond on them. The claims are on the serpentine contact west of the old City of Six gravel diggings in the head of Slug canyon.——Good ore has been found in the old Kate Hardy mine, near Forest. The ore carries considerable galena. Tyler Dudley is in charge of the work.——A 2-ft. vein was cut by the cross-cut from the bottom of the shaft at the Bixby mine.——W. F. Corbett, of Lake county, has bonded the San Fernando quartz mine, on St. Charles hill. ——H. L. Johnson and L. P. Woodbury, who have the Rainbow mine, at Alleghany, under lease, have cut a shoot of high-grade ore which assays $60 per lb. The find was made 400 ft. below the old workings.

TRINITY COUNTY.

The Trinity River Mining Co. has let the contract for hauling 120,000 lb. of freight from Redding to its mine, two miles above Lewiston, to Frank Dalton. The company recently completed a long tunnel, through which the Trinity river is to be diverted while the river-bed is worked for its placer gold.——A 28-in. vein was cut by a raise in the Oriole mine. John Shuford is superintendent.

COLORADO.

CHAFFEE COUNTY.

The Mary Murphy mine on Chalk creek has been purchased by an English syndicate. A 100-stamp mill will be erected by Harold F. Carpenter, who is the company's representative at the mine.

CLEAR CREEK COUNTY.

(Special Correspondence).—Work will be resumed some time next week in the advance of the Vidler tunnel in East Argentine. The transmission line for the delivery of electric power has been completed. This tunnel is to be driven during the summer and fall months from both ends, and it is hoped that connection will be made before the cold weather arrives. About 2200 ft. of ground remain to be broken. The bore will be equipped with a trolley system, but is designed primarily for railroad purposes. The property is now owned and operated by the Argentine-Montezuma M. M. T. & T. Co., financed by English capitalists.—— The Donaldson and Centurion mines, embracing an area of 400 acres of mineral-bearing ground on Donaldson Mtn., have been consolidated. A working fund of $250,000 has been subscribed by English and New York capitalists and a big force of men will be employed. The corporation will be known in the future as the Donaldson Mines Co. It has also secured the Carpenter smelter at Golden. The capacity at the present time is 500 tons per day, but another unit may be added. It is reported that a lead furnace will be installed. H. A. Reidel, of Denver, is general manager for the new company.——It is expected that during the next week the raise being put through from the west drift of the Phillips vein will make connection with the Seven-Thirty shaft workings. J. H. Robeson, manager, stated that it would be necessary to cross-cut 30 ft. to reach the shaft. Already 25 ft. of ground has been broken. Great care is being exercised, as the shaft workings embrace seven miles of levels and drifts which are nearly all filled with water. ——The new adit started at the Josephine mine on McClellan Mtn., cut a streak of lead ore from 6 to 10 in. wide, assaying from $60 to $65 per ton in silver and lead. This adit was started about 250 ft. farther up the hill from the lower workings for the purpose of proving the continuity of the ore-shoots.——A vein of ore 13 ft. wide has been cut in the adit being driven on the Centennial, on Leavenworth Mtn. Samples assay from $15 to $20 per ton in gold, silver, and copper. It is reported that some time during the present year this property will be equipped with a stamp-mill. Water for the operation of the machinery will be pumped from the shaft workings of the mine. David Kennedy is manager.——Byers & Co., leasing on the Everett and Lebanon mines, Republican Mtn., have encountered a 16-in. streak of wire silver that mills from $115 to $125 per ton in silver and lead. A raise is being carried from the Everett level to connect with the Lebanon workings, about 200 ft. above.——On the Pay Rock Extension vein, a streak of $90 silver-lead ore from 6 to 8 in. wide is being followed.—— Another lode was cut in the Prudential adit this week. Only scattered ore is showing. F. A. Maxwell is manager.—— Ericson & Co., leasing on the Seven-Thirty, had a shipment of 11 tons of ore last week that was settled for on the basis of 625 oz. silver per ton, and 18% lead. They are stoping on a streak of ore that is from 12 to 18 in. wide, the ground having been opened for 90 ft.——Bowen & Co., leasing on the Frostberg, are sending out regular shipments of both first and second-class ore. The lead-zinc is being sent to the Mendota mill. The smelting product is sold at the Georgetown sampler. The first-class returns from $76 to $80 per ton. Glasson & Co., leasing on the same property, are stoping smelting ore from 16 to 20 in. wide, assaying 150 oz. silver per ton.——At the Smuggler mine, on Brown Mtn., in addition to lessees, a good force of men is being employed on company account. B. C. Catren, Jr., is resident agent.

Georgetown, May 28.

GILPIN COUNTY.

The Great Bonanza Gold Mining Co. is continuing development work on its Next President mine, on Bobtail hill. Two winzes have been sunk from the 460-ft. level in a vein that is from 3 to 5 ft. wide. The ore assays about $8 per ton. Cecil C. Morgan is manager.——Cross-cutting is being carried on in the west side at a depth of 700 ft. in the Buell mine, in Gregory district, to cut the veins of the Buell group. Herman Lundberg is in charge of the development. A raise is also being cut through from the 600 to the 500-ft. level, on the east side of the shaft. The Buell mill is keeping 45 stamps dropping steadily on Buell and custom ores, it being necessary at times to run the mill all night to handle the increasing supply. Charles Cox is foreman.—— The Leavenworth mine, in Leavenworth gulch, has been started up by Clinton Reed and associates of Denver. Work is being carried on at a depth of 200 ft., where they are driving on the vein for the junction with the Calhoun vein. Two classes of smelting ore are being shipped, to thoroughly test its value. Wm. C. Le Prowse is in charge of the work.——A pool of Austrian lessees have started up the San Juan mine, on Quartz hill. They are shipping over the lines of the Gilpin Tramway company to Black Hawk mills for treatment.——Alfred Anderson has started up the Casto mine, on Winnebago hill, and is keeping up some development work in the lower levels. There is a first-class plant on the property.

LAKE COUNTY.

Lessees of the Chrysolite property on Fryer hill are making regular shipments. The ore is chiefly iron, but occasional rich streaks of silver are cut. Peter McCree-

vey is the manager of the property.——Work has been started on the towers for the aerial tramway that is to convey the ore from the Tucson mine to the Denver & Rio Grande railroad.——The Coon Valley mine on Rock hill has entered the contact between the porphyry and lime at a depth of 800 ft. and drifting along this contact has now been started. Frank Feehan is superintendent.——Twenty-five tons of lead ore is being shipped daily from the Gnu shaft on the Nisi Prius property, which John Harvey has under lease.——The Langola Mining Co. has started operations on the Pyrnees property on upper Carbonate hill. A new pumping plant has been installed which is expected to drain the mine in several weeks. A. E. Hanifen is manager. ——The Cleveland shaft of the New Monarch Mining Co. on Little Ellen hill is shipping 120 tons per day. The ore is coming from the fourth, fifth, and sixth levels. A cross-cut has been started from the bottom of the shaft to tap the vein.——The Tenderfoot mine in South Evans gulch is producing 25 tons of ore per day.

SUMMIT COUNTY.

The May clean-up of the four large dredges, two on the Swan and two in French gulch, will approximate $100,000. All four are operated by electricity.——The O'Reilley property has a 3-ft. vein of sulphide copper and iron ore in the face of their 260-ft. tunnel.——The Country Boy, in French gulch, is producing about 30 tons of zinc-lead ore per day.

TELLER COUNTY.

The Cresson Consolidated Gold Mining & Milling Co. is taking from 80 to 90 tons of ore daily from its properties on Raven and Bull hills. The ore is being mined from the fifth to the ninth level inclusive and averages about $25 per ton.——Lessees are making regular weekly shipments from the Silver Tip mine to the Golden Cycle mill at Colorado City.——The Blue Bird Leasing Co. is taking out about 1000 tons of ore per month from the Blue Bird mine on Bull hill.——An amalgamating and concentrating plant for the treatment of the tailing dump at the site of the old El Paso Reduction Works, near Gillett, is to be installed by George K. Kimball, of Idaho Springs, who has secured a lease on the dumps. These have been sampled and the average value has been found to approximate $2.50 per ton, while the cost of treatment by the method proposed will be less than $1 per ton. An 18 months lease with graded royalties has been secured by J. D. Bryant on the Nil Desperandum and Rhinoceros lode mining claims on the northwestern slope of Raven hill, owned by the Gould Mining Company.

The Iowa Leasing Co., operating the Four Brothers claim of the Agnes Gold Mining Co., has cut a station at a depth of 450 ft. on that Beacon hill property and has commenced driving on the vein exposed near the shaft, in search of an ore-shoot.——A depth of 435 ft. has been reached in the main shaft of the Little Nell gold mine, and sinking will be continued until the 500-ft. point is reached. At this depth a station will be cut and a cross-cut will then be carried to the west side line. At the 300-ft. level a vein of low-grade ore has been exposed.——The W. P. H. mine shipped four cars of milling ore.

IDAHO.

SHOSHONE COUNTY.

Carbonate, ruby silver, and galena ore has been cut in the face of the drift on the Clear Grit Mining Co.'s claims near Delta. They have a depth of 440 ft. on the dip of the vein. ——Four feet of galena ore has been cut on the Samson Mining Co.'s property about eight miles west of Murray. The ore, which was encountered in the face of the drift when in 110 ft., assays high in lead and silver.——The Black Horse mine furnished the ore for the first shipment to go all the way by rail from the Murray district to the smelter. The consignment was sent over the Idoha Northern railroad.

Ore was cut in the adit of the Samson Mining & Development Co. when in 111 ft. The assay of this was 65% lead and 116 oz. silver per ton.——Four feet of galena ore has been cut on the property of the Samson Mining Co., on Upper Eagle creek, about eight miles west of Murray. A. J. Brainard is manager for the company.——The H. E. M. Mining Co. shipped its first car of ore to the smelter at Tacoma. The ore assays 70% in lead and 30 oz. silver per ton.

KANSAS.

CHEROKEE COUNTY.

A promising ore deposit has been developed west of the business centre of Galena and a 300-ton mill has just been completed by George McCullagh. The plant is in two units, each having a capacity of 150 tons, being built in this fashion because the ore from two leases must be treated separately. Several shafts are down to the orebody and sufficient drifting has been done to ensure good production. ——Since the successful drainage of old Short Creek Bottoms there are a large number of sub-lessees at work on this tract. The water is down to the 80-ft. level over most of the land, while at the Murphy mine it is drained to 100 ft. Most of the lessees have opened old shafts and hardly one has failed to find rich ore at shallow levels.——The Lockport Co. has recently acquired the Brinkerhoff land adjoining Short creek bottoms and has installed a centrifugal pump for its immediate unwatering. This will make available for mining purposes 80 acres additional.——A cave-in on a residence lot in the heart of Galena revealed rich ore, and since the removal of the residence a company has leased the lot and has begun mining. A shaft is being sunk through solid ground in order to get to the ore. The mineral is in a loose sand formation and only requires washing to be ready for the market.——The Lizzie D. Mining Co. at Peacock is sinking another shaft on its lease 200 ft. from the former shaft. The new shaft is at the 300-ton mill which will be completed in another month. The ore is found from 173 ft. down.

MISSOURI.

JASPER COUNTY.

Among the recent strikes in this district is an accidental ore find near Lakeside Park by C. T. Bunce while drilling a well. The ore was encountered at 218 ft., continuing to 230 ft. This is the first strike in this vicinity, and as a result there is a great demand for leases on adjoining lands.—— One of the best strikes made in the Neck City camp recently occurred on the 1909 lease of the Quick Seven land. The ore was reached at 72 ft. and continued for 15 ft.—— Rich 'rosin jack' was struck in the Blendeville camp on the old Colorado tract, from 27 ft. to below the 42-ft. level.—— Several drill-holes on the Nowata Mining Co. property are in ore of the sheet formation.——The Little Pitcher Mining Co. at Chitwood has cut a 12-ft. vein after sinking a number of holes in the floor of the drifts.——The Little Hatchet Co. at Duenweg has found a 7-ft. vein of ore at 165 ft.——The ore is being cleaned on hand-jigs.——The Mary Ann Co. is building a mill west of Joplin on a sub-lease of the Morning Hour. Three shafts down to the ore will supply the mill, and a number of dump piles, the accumulation of previous development, will be treated soon.——Two shafts are down 140 ft., with the third down 167 ft.——The new Mandarin, a 400-ton plant, is beginning production near the Chicago-Joplin plant. A shaft is being sunk near the mill to supply the plant.

LAWRENCE COUNTY.

The new Coleman Bros. plant is being rapidly completed, the machinery being now installed. A large dump pile rich in ore is awaiting treatment. The company waited to build the mill until sufficient dirt had been taken from the ground to pay the construction.——Mains & Co., working on the Boston-Aurora ground, cut the ore at 41 ft. The shaft is down 56 ft.——Ore has been cut on the Jones land. The strike was made at the same depth as that made last year by the Federal Zinc Co.——At McDowell, south of Aurora, a new 200-ton plant has been finished for the treatment of the blende ores at the lower levels. At present the mill has a capacity of 100 tons and is used for the silicate ores found at a shallow depth. One shaft is down 165 ft. and the second 220 ft.——Plans are under way for the re-opening of the Springfield mines. During the past week a second run has been found, the zinc being unusually rich. It is said that over $70,000 worth of zinc-blende has been taken from the Baker tract.

NEWTON COUNTY.

The McKee Mining Co. has just completed a new mill in the Spring City camp and the initial run will soon be made.——Scott & Bankard are installing new machinery on their lease. The company cleaned out the old shaft and found a good run of galena and zinc-blende.——The Silver Plume Mining Co. is to resume operations after a shut-down since last December. This property was developed last year and was the first of the sheet-ground properties in the Granby camp. The shaft is down 229 ft., showing both galena and zinc-blende.

NEVADA.

ESMERALDA COUNTY.

The Lodi smelter, 43 miles northeast of Luning, is to be blown-in during the early part of this month. The initial capacity will be 100 tons per day, drawn largely from the Lodi mine. A small amount of custom ore will be accepted at first, and if the run proves successful the smelter will be enlarged. The Lodi mine has attained a depth of 800 ft. on an ore carrying silver, lead, and gold.

A dividend of 30c. per share was declared by the Goldfield Consolidated. The cost of operations at the new mill is $2.18.——An improvement has been made in extraction at the Combination mill by the installation of a few more concentrators, and by the selection of ore more suited to the limitations of the plant, which was not designed for the purpose of treating sulphide ores.——A drift has been run 200 ft. along the orebody that was cut a short time ago in the workings of the Red Top and Lucky Boy mines. The width of milling ore varies from 15 to 30 ft.——Stations are being cut in the Clermont shaft at the 733, 866, and 1000-ft. levels, preparatory to starting lateral work for reaching the downward projection of known orebodies on the Mohawk and other veins in this portion of the Consolidated territory. Ore-bins of 200 tons capacity are to be constructed at each station, below the levels, and provided with chutes so that the ore can be readily dropped into cars or skips in the shaft.——After idleness of several months, work has been resumed on the Hazel Goldfield lease on the Last Chance claim of the Consolidated property. A much heavier hoisting plant will be installed and drifts, cross-cuts, and raises driven to explore the territory from the 720-ft. level.——A dividend of $32,000 was declared by the board of directors of the Round Mountain Mining Co. It is expected that the new electrical equipment will be installed by the middle of June, and this will probably increase the capacity of the mill about 25%.——Drifts are being run on the 400 and 500-ft. levels of the Diamondfield Daisy, and ore is being shipped from the 250 and 300-ft. levels. The ore is smelting rather than milling, and when the Goldfield-Ely railroad is completed it will be easier to market it than at present.——A cross-cut from the shaft on the C. O. D. Consolidated at the 400-ft. level has cut a body of ore that runs from 6 to 20% copper.

HUMBOLDT COUNTY.

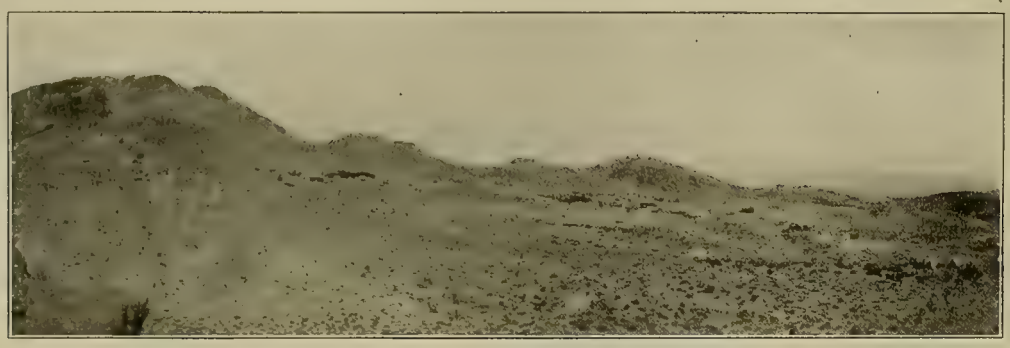
The Seven Troughs Trio Mining Co., operating on Mazuma hill, has the mine workings pumped out and the shaft nearly to the 200-ft. level. At this point a station will be cut and a cross-cut run to the vein.——Five stamps of the Coalition mill have been turned over to lessees to mill the ore from the Wihuja mine. The Wihuja has completed the station at the 425-ft. level and will drive on the vein from that point. The ore assays between $50 and $60 per ton.

LINCOLN COUNTY.

(Special Correspondence).—The Quartette mine is showing up splendidly, with large reserves opened in the lower levels and 40 stamps dropping constantly. One hundred men are employed and work is going forward at numerous points.——A vein of low-grade ore which had been driven on for 25 ft., has been cut on the 300-ft. level of the Pittsburg Searchlight. The ore will be stored until fall, when it is planned to erect a new mill.——The shaft at the Philadelphia Searchlight is going down steadily to the 1000-ft. level. The company has expended approximately $50,000 in the past three months in development work and machinery. The shaft is double-compartment and will cut the vein system at considerable depth.——At the New York Searchlight a cross-cut is being driven to cut the vein. A compressor and drill were recently installed.——Arrangements have been made for the re-opening of the Wharton mine, in El Dorado canyon. This property has been idle for several months, although considered a valuable mine. E. M. Martin is superintendent.——The Empire is still tied up by litigation, with little prospect of an early settlement.——An 18-in. shoot of ore running about $100 per ton has been intersected at the Pompeii mine. The 10-stamp mill is running steadily on Pompeii and custom ore.——The Chief of the Hills lease, on Quartette holdings, has leased the Cyrus Noble mill and is treating all ore running less than $100 per ton at this plant. Richer ore is shipped to the Needles smelter.——Ten stamps are dropping on good ore at the Duplex.——Searchlight is more active now than at any point of its history. Approximately 1000 men are working and 80 stamps are dropping. The mines are showing improvement with depth and several promising prospects are receiving attention.

Searchlight, May 28.

The shaft on the Alunite claim in the Alunite district is down 340 ft. and that on the Homestake 285 ft.——One hundred tons of manganese ore have been shipped by the Prince Consolidated mine at Pioche to the Tintic smelter. William Lloyd is superintendent.



Pioneer, Nevada. Ranger Lease May be Seen on the Left.

NYE COUNTY.

Some excellent results are being obtained from the work at Pioneer. The town is situated eight miles north of Rhyolite and is within two miles of the Tonopah & Tidewater tracks.——The Keane Wonder cut a new shoot of ore that ran above the average at the mill. A head-frame has been erected over their new shaft and a hoist is to be installed. Drifts will be started as soon as the hoist is completed.——The Pioneer Leasing Co., working on the Pioneer Bullfrog property, has a 30-ft. breast of ore open. The strike of this vein is approximately north and south, with a 55° dip to the west. Smelter returns from this property

were about $200,000 for last month.——Two new orebodies have been cut on the Pioneer lease at Rhyolite, about 100 tons of ore is being taken out daily.——The Jefferson mill at Round Mountain is about completed and expected to start soon.——The Rusty Pick Consolidated property has been sold to Eastern capitalists, headed by W. N. Mitchell, of Chicago, and C. W. Hayes, of Goldfield. The Rusty Pick is situated at Ibex and comprises 10 claims. There are about 200 ft. of development work completed upon the ground. One shipment was made at the time that the work was done which was settled for at the rate of $150 per ton.—— The option on the divide group of claims, on Quartzite mountain, has been taken up and the Boston capitalists are now in control of the property. W. H. Spalding has been put in charge.——Milling ore has been cut on the Tripolite property at a depth of 220 feet.

A connection between the 600 and 770-ft. levels of the Tonopah Extension has been completed. The annual report of this company was mailed to its stockholders, and in accordance with the recommendations the directors have decided to erect a 30-stamp mill.

OKLAHOMA.

OTTAWA COUNTY.

One of the deepest and richest strikes in the Miami camp has just been made on the lease of the Miami-Yankee Co. north of the Emma Gordon. The ore occurs below the 200-ft. level, whereas the usual run in this camp is worked from 90 to 105 ft. Two holes have been sunk, finding both galena and zinc-blende.——J. W. Barnes also reports a rich drill-strike in the same vicinity at a depth of 306 ft. Previous drilling showed ore from 187 to 215 ft.——The Turkey Flat Co. is putting up a second-hand plant of 200 tons capacity. ——Among other companies erecting mills is the Consolidated, with the material on the ground and the plant started. ——The Little Maxine has its mill almost completed.—— The Last Chance and Blue Bell have each bought old mills which will be re-modeled.——A good zinc strike was made at Bluejacket recently when a 35-ft. vein of ore was penetrated at a shallow depth.——The first shaft is being sunk in the Fairland camp by Frankenburger and Varner. A considerable amount of prospecting has been done, showing rich beds of lead and zinc in this vicinity.

UTAH.

BEAVER COUNTY.

A shaft has been sunk on the vein of the Moscow Bonanza property by a Salt Lake company holding a lease on that property. The ore averages $20 gold, 67 oz. silver, and 1% lead. A shipment will be made soon to the Salt Lake smelter. The company will drive each way on the vein at the 100-ft. level. Dan Ferguson is in charge of the work. ——The Red Warrior, in the Star district, is shipping two cars weekly to the smelters. The ore is loaded at Milford. ——On the 700-ft. level the Beaver Carbonate has cut an orebody 35 ft. wide. Samples from this orebody recently sent to Salt Lake assayed 10 oz. silver and 10% lead. The company is continuing the raise on the orebody encountered closer to the shaft, and this is looking very good, the ore being a shipping grade. Grant Snyder is manager.

SALT LAKE COUNTY.

The Bingham Mines Co. has secured a contract with the American Smelting & Refining Co. for the smelting of its ores from the Dalton and Lark mines at Lark. This contract will permit the Bingham Mines Co. to maintain steady ore shipments, and it will open the way for a much more extensive campaign of development work at depth in the properties. The company has been shipping in a small way for some time, selling its lead ores on the open market, but this has proved unsatisfactory. Imer Pett is manager.

WASHINGTON.

OKANOGAN COUNTY.

Two drifts are being run on the 150-ft. level at the Olentangy mine.——The Copper World Extension Co. is building a wagon-road along the backbone of Palmer Mtn., to connect with an old road through Golden to Oroville. When completed the company will ship a test carload of ore. If the returns warrant, shipments will be continued.—— The Nighthawk Mining Co. is sinking a double-compartment shaft to a depth of 200 ft. Ten stamps are dropping in the mill, and a carload of concentrate will be shipped in a few days.——A contract has been let by the Favorite mine to mine and mill 100 tons of ore to determine the advisability of erecting a mill at that mine.

STEVENS COUNTY.

Work has been started by the United Copper Mines Co., of which Conrad Wolfle, of Spokane, is president on an adit which will give a depth of 1100 ft. below the present workings in the Chewelah district. It is to be 3000 ft. in length and will connect several properties. Mr. Wolfle also reports that 14 ft. of low-grade ore has been encountered on a 350-ft. adit in the Copper Cliff property on Quartzite Mtn.——The Alladin Mining Co. has a large body of galena ore blocked out near Northport, and is installing a concentrator and constructing a large flume to conduct water for power, etc. The company owns a sawmill and has a traction engine for facility in hauling. Peter P. Swanson, of Spokane, is the manager.——Rails and cars have been delivered to the Pittsburg mine on O'Toole Mtn. and work started at the adit level.——A diamond-drill has been installed at the Sunset mine and prospecting will be carried on from the 400-ft. level.——The Bornite Mining Co. has driven an adit 600 ft. and cut about 8 in. of ore. In driving 30 ft. on the vein the ore widened to over 18 in., and assays as high as 19% copper and from 5 to 20 oz. silver per ton. The face of the drift is about 250 ft. from the shaft. It is planned to build a flume from the head of Coyote creek, 1300 ft., to carry water for power sufficient to run all the machinery. Machine-drills are to be installed and preparation made to ship ore. The portal of the adit is so near the bank of the Pend Oreille river that the ore can easily be delivered from the dump to the river barges.——The Metaline Lead Co., of Metaline, has purchased a one-third interest in the Coupon, Mystery, and Dividend claims, in Metaline district.

CANADA.

BRITISH COLUMBIA.

The Placer Gold Mines Co. of Seattle has 55 acres of placer ground on Ruby creek, 17 miles east of Atlin. A flume, pipe-line, and two giants, with the necessary sluices and riffles, constitute the equipment. The placer ground is 50 ft. deep. From the bottom of the shaft drifts have been run on the bedrock which permitted a sampling of that part of the ground. The sampling indicates a value of $1.66 per yard from the 10-ft. level to bedrock. T. M. Daulton, of Seattle, is general manager of the property and is on the ground directing the work.——The Granby smelter at Grand Forks and that of the Consolidated company at Trail are receiving large shipments from the surrounding districts. The Granby is handling between 25,000 and 30,000 tons per week and the Trail smelter 8000 or 9000 tons weekly.——In the north vein of the Centre Star mine a new orebody has been uncovered which assays about double the usual run of the mine, while the big orebody in the War Eagle, estimated to contain one million dollars in values, is practically untouched.——Phil O'Connor, of the Lardeau, who located a copper property on Queen Charlotte island, has bonded it to the Granby Consolidated for $100,000.——G. H. Wright, of Vancouver, has taken one year's bond on the Majestic group of claims on Payne mountain, at Sandon, from F. H. Bourne, of Revelstoke, and Charles French, of Vancouver.

ONTARIO.

The Coniagas Reduction Co., Ltd., whose smelter is at Thorold, is to double the capacity of that plant. This addition is to handle the increase of 120 tons per month from the Coniagas mine and 180 tons custom ore.——The Keeley mine, situated about four miles west of Cobalt lake, is installing a new power-plant. It consists of a 150-hp. gas engine to drive a 12-drill compressor and a 35-hp. gas hoisting engine. Boyd Magee has charge of the work.——A 5-drill compressor is being installed at the Wettlaufer mine. The shaft is down 50 ft. and has cut silver ore. A. C. Bailey is superintendent.

Special Correspondence.

LONDON.

Murex Process.—Ekenberg Peat Investigation.

Few facts regarding the Murex magnetic process are yet available. The patents are not yet published, and the inventors naturally do not disclose full details. The process is a wet one. The plant is not dissimilar from that used by Wetherill. The pulp is passed in a thin layer upon a belt, or a Zimmer conveyor underneath, behind which is a magnet. The pulp has been preliminarily mixed with an emulsion of magnetite and oil, and the metallic particles become agglomerated into granules which are sensitive to the action of the magnet. They are taken up by the belt and are carried out of the magnetic field. The unaffected gangue passes over the end of the conveyor or belt and goes to the tailing heap. The amount of emulsion used per ton is comparatively small. The Murex should not be confused with flotation processes. It is, however, possible, that the owners of the Elmore and Minerals Separation processes will argue that the use of oil as a selective agent for the agglomeration of metallic and sulphide particles and to effect adherence thereto of the magnetite, is, to that extent, an infringement. The Murex inventors claim as their great advantage that the process will work with high efficiency on all sorts of ores which are not amenable to other flotation processes. Critics of the process point out that costs will be higher than with other oil concentration processes, inasmuch as the provision of magnetite, and its subsequent removal from the concentrate, have to be considered, in addition to the cost of the electromagnet. Probably employment of the process, when a high commercial extraction can be obtained by the other processes, is not contemplated. In the Murex process it is proposed to effect a separation between the various sulphides in such ores as those of Broken Hill, complex galena and blende mixtures difficult to separate owing to the intimate crystallization, by the admixture of a small quantity of alkaline silicate. The Murex process as applied to Broken Hill ores is to first treat the raw ore in the wet magnetite process, and then use process No. 2 for separating the galena and blende.

From time to time we hear acounts of new methods invented for utilzing peat for fuel. All have failed so far because of the difficulty of removing the water economically. The water which is present in a free form can be removed easily, but the bulk of it is combined with cellulose and cannot be removed by any mechanical means. The application of heat is effective, and the question is one of economy. If the peat be dried by means of hot air or gases the amount of fuel employed is as great as that which is produced by drying the peat. It must be remembered that ordinary peat contains about 85% of water and only 15% of solid matter, so that there is an enormous proportion of water to be evaporated. Drying by the sun in the open air is far too tedious, uncertain, and expensive a process. Dr. Martin Ekenberg, a Swedish engineer, has evolved a new method. In 1903 the Swedish Government recognized the value of his research and placed funds at his disposal. His process is to break up the hydro-cellulose in retorts to which water at temperatures of from 150 to 200° C. is admitted. This heat is sufficient in a very short time to free the water from the combination, so that if on removal from the retort the peat is subjected to pressure, practically the whole of the water can be expelled without difficulty. A briquette is produced which readily burns, and which can also be used for the manufacture of charcoal. At the meeting of the Iron & Steel Institute recently Dr. Ekenberg read a long paper on the subject, giving a history of his experiments. It is claimed that the amount of heat and power used in breaking down the hydro-cellulose by hot water under pressure and subsequently removing all the water in a press, is far less than is required to expel the water by means of dry heat. The process apparently would be somewhat expensive on account of being discontinuous, but it is of great interest where good fuel is scarce.

BRITISH COLUMBIA.

Trail Output. — Granby Shipments. — Coal Strike Settled. — Coke Ovens at Michel.— Sandon.—Gold on Cascade River.

Rossland mining and business men are becoming optimistic again, and in one sense they may well be so. The Consolidated smelter at Trail in April treated 35,490 tons of mixed ore, from which they extracted 410 tons of copper matte and 2264 tons lead bullion, containing gold, $214,835; silver, $101,891; copper, $44,232; and lead, $146,110; a total metallic production of $507,068. The refinery turned out 2012 tons of pig lead, worth $115,927; 2663 oz. gold, $54,959; and 148,128 oz. silver, value $75,485; a total of $246,371. From June 30, 1908 to April 30, this year, the Trail smelter has produced metals to the value of $4,088,940; of this the refinery must be credited with $2,096,461. The production of the Le Roi No. 2, Ltd., during April was something over 2200 tons, and the net profits of the company were in the neighborhood of $35,000. The gross output was $67,770. A 4-ft. vein of galena has been opened up on the Hattie Brown. The Mayflower has been leased to F. Neal and associates.

The Snowshoe and Granby were the only shippers from the Boundary district during the week ending May 22. The Snowstorm sent out 2120 tons, and the Granby 13,740. The shipments from the Granby mines during the next week or so will be much heavier, as furnaces No. 3 and 4 will be blown in during the coming week. Shipments from the Gold Drop adit will be resumed. It is understood that the Dominion Copper mines, which have been kept unwatered, will be worked again shortly. The amount that is still owing to the miners for wages will be paid immediately. The Argo company has commenced an adit to tap the high-grade veins running through the hill at South Greenwood. On the Golden Zone group, 12 miles from Hedley, the shaft has now attained a depth of 110 ft., and at that depth the vein is over 10 ft. wide and the ore assays $82.68, $45.47, and $20.67 in gold, with a little silver. The lode now worked has been traced on the surface for over 2000 ft. There are two other good lodes on the property, which consist of four claims—the Golden Zone, Irish Boy, B. C., and Silver Bell. All three veins are to be cross-cut at 200 ft. It is estimated that there is already enough ore ready for stoping to supply the 5-stamp mill, and this will shortly be put in operation. Work on the Kingston is giving good results; 12 men are working. A big strike is reported at Twenty Mile creek, on a property being worked by a party of Italians. The vein on the Bruse was cross-cut for 20 ft. on the surface last week, and assays taken returned from 8 to 20% copper.

The strike in the Southern Alberta coalfields, which has been holding back mining and smelting in this district, has been settled, the miners yielding on the open-shop question and the operators in regard to the matter of discrimination as to union men. This will assure a supply of coke for the British Columbia Copper Co. and other plants. The Crows Nest Pass Coal Co. has begun preliminary work on the 1000 coke ovens which will be built at Michel, B. C., during the coming summer.

A lead on the Anthony claim, near Nelson, was uncovered by T. Maher recently. It carries from $59 to $117 per ton in gold. This property was known to old-timers as the Robin Hood. The new lead has been exposed 150 ft. and looks very promising. Rumor has it that the Dunsmuir interests will shortly commence work on the Noble Five group at Sandon. This is a rich and promising property, which miners have endeavored in vain to lease during the last few years. There is a good concentrator on the ground which, with a few repairs, will be able to take care of the product of the mine. A strike of gold is reported from Devil's creek, on the Cascade river, near Bankhead, Alberta. Samples of the sand shown at Bankhead appear to carry gold in good quantities.

Leonard Hills, of Chicago, one of a group of capitalists who obtained control of a large area of coal ground on Graham island last fall, has gone East to arrange for the opening and development of the property. W. Evans, Pincher Creek, Alta, with E. Hodgson, of Vancouver, B. C.,

will have charge of the development work, and arrangements have been made for a production of 150,000 tons of coal in the coming 18 months.

WASHINGTON.

Land Laws. — Bureau of Harbors and Waterways. — Mexican Oil.— California Debris.—Tariff on Antimony.—Patent Laws.

A summary of the important land laws of the United States, written by Knute Nelson, Senator from Minnesota, for publication in the 'Annals of the American Academy of Political and Social Science,' has been made a public document (Senate Document No. 59). It can be obtained through his Senator or Representative by anyone interested. A proof of the article fell into the hands of C. D. Clark, Senator from Wyoming, who called attention to its usefulness and requested that it be printed by the Government. Sylvester C. Smith of Bakersfield, Representative from California, has introduced a bill in the House which provides that the public lands in the State of California, chiefly valuable for mineral oil or asphaltum, may be acquired for these purposes, but that such lands may not be located as placer mining claims. A bill to create a Bureau of Harbors and Waterways under the Department of Commerce and Labor was introduced in the House May 25 by James L. Slayden of San Antonio, Texas, Representative from that State. It was referred to the Committee on Interstate and Foreign Affairs. Mr. Slayden would have the bureau officered by a corps to be known as the Corps of United States Civil Engineers, the chief of the corps to receive a salary of $10,000 a year. The bureau would consist of the chief, 4 associate chief engineers, 9 department engineers, 50 division engineers, and resident engineers not to exceed 100. Another attempt to give water-power rights to citizens is made in a bill introduced in the House by William A. Oldfield, of Batesville, Ark., Representative from that State. The bill aims to give consent to the erection of a power-house upon lands belonging to the United States on the upper White river, Arkansas. The construction work must not impair the usefulness of any improvement made by the Government for the benefit of navigation. The bill also provides that the withdrawal of water from the river shall at all times be under the direction and control of the Secretary of War, who is authorized to fix, from time to time, reasonable charges for the use of its power.

'The daylight savings act' is a unique bill introduced in the House by Andrew J. Peters, Representative from Boston, Mass. The bill provides that between 2 and 3 o'clock in the morning of each of the first four Sundays in April in each year shall be a small hour, consisting of 40 minutes only, but shall otherwise be reckoned a full hour for all intents and purposes whatsoever in the United States; that the hour between 2 and 3 o'clock in the morning of each of the first four Sundays in each year, except 1909, shall be a long hour, consisting of 80 minutes, but shall otherwise be reckoned as a full hour.

C. D. Chamberlain, of Cleveland, Ohio, representing the independent oil men who are asking for a duty on crude oil, in a statement issued today declares that the investigations of David T. Day of the oil resources of Mexico leave no doubt that the production of Mexico is a menace to the interests involved in competition in the United States. He says that the investigation of Mr. Day has verified the prevailing opinion of the large extent and potentiality of the Mexican field. In a statement some days ago the independent oil men charged that the Standard Oil Co. controlled the Mexican fields, and that it therefore wanted free petroleum. As opposed to this view, Frank Flint, Senator from California, yesterday read to the Senate the following telegram: "Please deny to Congressmen and Senators that the Mexican Petroleum Co. is controlled by the Standard Oil Co. Newspaper reports and reports attributed to David T. Day to this effect have no shadow of foundation. Standard Oil Co. has no connection, direct or indirect, with our interests. Signed, Norman Bridge, Los Angeles, California."

First Lieutenant Charles T. Leeds, Corps of Engineers, was today nominated by President Taft as a member of the California Debris Commission, in place of Major Charles H. McKinstry, who is to be relieved. The nomination was confirmed by the Senate. Professor Simon Newcomb, the astronomer and mathematician, who has been seriously ill at the Johns Hopkins Hospital, Baltimore, Md., has recovered sufficiently to return to his home at Washington.

On the promise that a new industry would result, the Senate placed a duty on antimony, as regulus or metal, of 1½c. per lb.; on antimony ore, stibnite, and matte containing antimony, 1c. per lb. on the antimony content therein contained. It was shown by J. M. Dixon, Senator from Montana, that under present conditions the United States is importing from $1,000,000 to $2,000,000 worth of ore and metal every year, rising from 3,900,000 lb. in 1904 to nearly 9,000,000 lb. in 1907. He declared that nearly all of it is imported, notwithstanding the fact that in 10 or 12 of the Western States antimony ore is found in abundance.

Porter J. McCumber, Senator from North Dakota, has introduced a bill to provide for the utilization of State and Territorial lands in connection with projects under the Reclamation Act. Briefly, the bill provides that if the title to any lands which are acquired for a project under the Reclamation Act be vested in any State or Territory by any act of Congress, other lands of equal acreage in lieu thereof be appropriated and granted, and may be selected by the State or Territory. Robert J. Gamble, Senator from South Dakota, has introduced a bill to authorize the sale of a portion of the surplus and unallotted lands in the Pine Ridge Indian Reservation, in the State of South Dakota. Charles H. Burke, Representative from the same State, has introduced a bill to authorize the sale of the surplus lands in the Rose Bud Indian Reservation.

An amendment proposed to the statutes relating to patents covering inventions which may be of far-reaching importance, has been introduced in the House by John A. Moon of Chattanooga, Representative from Tennessee. The amendment provides that where patents were granted within 17 years and 9 months preceding the date of the passage of this act, the inventor shall have the right to request an extension of his patent beyond the original term of its limitation, under certain conditions. The question of extension of time shall be referred to the Court of Claims. If the patentee can show that without neglect or fault on his part he has failed to obtain from the use and sale of his invention a reasonable remuneration, the patent will be renewed for a period not to exceed 17 years. A plan to erect an electrical power-plant at Portales, New Mexico, for irrigation purposes, has been proposed by William H. Andrews of Albuquerque, New Mexico, Delegate to Congress. Although the Government now has an experiment station at Pittsburg, Pennsylvania, for testing the fuels of the country, C. Bascom Slemp, Representative from Big Stone Gap, Virginia, wants a station in his own district. He has introduced a bill providing for an experiment station at Norton, Virginia.

MEXICO.

Graphite in Sonora.—Zinc Smelting.—Oil Discoveries.

The Santa Maria graphite mines, which are owned by the U. S. Graphite Co., of Saginaw, Mich., are situated about 20 miles south and a little east of La Colorada, in central Sonora. They are the largest amorphous graphite mines on the Western Hemisphere, and probably in the world. The country rock is composed of metamorphosed sandstone, ranging in fineness from shaly material to conglomerate containing pebbles 1½ in. diam. Considerable andalusite in small crystals is developed in the sandstone. The rocks are probably of Upper Triassic (Richmond) age. They are intruded by granite, which has been the metamorphosing agent. Intercalated with the sandstone are at least seven beds of graphite, ranging in thickness up to 24 ft., and standing at high angles. The rocks are considerably folded, and the graphite beds show the effect of movement more than the enclosing sandstone, so that they are in places almost cut off through squeezing, while in other

places they show thickening. The graphite beds are also intruded by granite dikes, and in places the walls are of granite. The graphite was undoubtedly formed through the metamorphism of coal beds, which in other parts of the State are to be found in the form of graphite, coke, anthracite and bituminous coal. The graphite of the Santa Maria deposits is entirely amorphous, and from the main vein worked averages 85 to 86% graphitic carbon. Specimens may be picked which carry 95% graphitic carbon. The company is steadily mining graphite and has accumulated a considerable amount at the mine, as no shipments have been made for some time. However, it expects to begin shipping again shortly. It is working about 30 men in one shift. The graphite is shipped to Saginaw, Mich., for refining. A large part of the best pencils, both of European and American manufacture, are made from this graphite. It is also used for a lubricant, powder coating, and foundry facings. A few miles north of Torres, and three miles west of the railroad, a Pennsylvania company owns graphite deposits, for which a good price was paid a few years ago. A small amount of graphite was shipped, but the property is now lying idle, and it is said that the quality of the bed is not of the best. Prospecting is being carried on for graphite on the east side of the Yaqui river, a few miles above Onavas. The geology is similar to that of the deposits at Santa Maria, about 75 miles west. At San Marcial, between Santa Maria and Onavas, coal is found partly graphitized, and at points on the Yaqui river above Onavas unaltered coal beds are reported, which it is said the Southern Pacific controls and will use for fuel on its Mexican lines.

The attempts being made at Washington to have a duty placed upon zinc ores have given rise to new talk of a zinc smelter in Mexico. Judging by the number of concessions that have been asked of the Mexican Government during the last several months, it would seem probable that something may result. The subject of a zinc smelter in Mexico was gone into most extensively and minutely several years ago by the late A. K. Bohn, who had interested with him J. F. Johnson of Parral. For a time it looked as though the proposition was going to be carried through, but unfortunately Mr. Johnson was at that time engaged with a proposed lead smelter at Jiminez, in connection with the mining interests he was acquiring in the Parral and Almoloya district. He abandoned the zinc smelter to push the lead plant. The latter required more capital than Mr. Johnson was able to command, and the result was that both schemes fell through. That a zinc smelter in Mexico would be a paying proposition is generally believed, and should a tariff be placed on zinc ores entering the United States, it would seem that Mexico would be forced to build zinc smelters. The most natural point for the location of a zinc-smelting plant is at Monterrey, in the State of Nuevo Leon. Here is the centre of a very important district, producing carbonate of zinc of an exceptional quality, and with Mexico's largest coalfields nearby the conditions seem ideal. As a distributing point one could not ask for better. Railroads run to the north, south, east, and west, reaching all parts of the Republic and the gulf port of Tampico. In addition to these favorable conditions, there is at Monterrey a steel plant and rolling mill. Galvanized iron could be turned out on the spot, and by lowering the cost of all galvanized iron products greatly increase the already large demands throughout Mexico. Several of the largest zinc companies in the States have for a number of years had ore-buying agencies in Monterrey, and now the business interests of that city are trying to arrange for the erection of one or more zinc smelters. Mining interests are also endeavoring to have the National Railway of Mexico construct a line from a point on the Monterrey-Matamoras branch, probably Los Herreros, out through Cerralvo, Sabinas Hidalgo, and on to the main line of the National at Villaldama thus opening up several rich lead and zinc districts, and extensive agricultural sections as well. Partial surveys and some grading were done several years ago on this line.

From a great oil war, which has not been remarkably apparent, though there has been a slight lowering in the price of oils at certain central points, talk is now switched to an enormous ₱30,000,000 merger between the S. Pearson & Son Co. and the Waters-Pierce Oil Co. It is not improbable that such a merger may be brought about, though in the meantime each company is going on with its business and prospecting. After three years of prospecting at Sarlat, Tabasco, in which time 11 holes have been driven, the Pearson people have at last, at a depth of 1730 ft., struck an oil with gravity of only 48. It will burn in the torch without refining. The well flows 40 barrels natural, but is said to pump 500. Another hole will be immediately put down. There is some hope of a railroad to that point, and a refinery as well, as the location at Minantitlan is proving very unhealthy and unsatisfactory.

SALT LAKE, UTAH.

Silver King Ore.—Big Deal in Tintic.—Cole-Ryan and Ohio Copper.

Some significance is attached to the fact that Thomas Kearns, one of the largest stockholders of and general manager for the Silver King Coalition Mines Co., entertained John D. Ryan on his recent visit to Utah. It is surmised that when Ryan was here some arrangement was made by which he could get the Silver King ore for the new smelter. When David Keith, the president, and Mr. Kearns left hurriedly for New York a few days ago, it was taken for granted that their trip had something to do with transferring the Silver King smelting contract, which had been made with F. Augustus Heinze, to the International Co. The Silver King has been the greatest silver-lead producer in Utah for a number of years. It is in the Park City camp and its profit distributions aggregate over $11,000,000 to date. It is now paying 60c. per share annually, in quarterly disbursements, and usually adds an extra dividend during the holidays. The ore blocked out in its workings is sufficient to continue shipments at the present rate for 10 years, and the company owns a large acreage of virgin ground.



Tintic Smelter.

Tintic district has done well for the past two years. No other mining district is credited with the same number of dividend payers. The Knights are the largest owners of producing mines in the section, and are in control of a score now being developed. The United States, American, and International smelting companies have sought entrance into Tintic, and have had under consideration the purchase from Knights of the Iron Blossom and Colorado mines, the Tintic railroad, and the Tintic Smelting Co.'s plant. All the smelting companies have made bids for the mines, but do not seem inclined to take the smelting plant, which represents an investment of $1,000,000. As all three bids have been submitted, the last one by the American, some sort of a deal is expected to be announced within a short time. In the Tintic district a great deal of development work is being carried on, especially in the eastern portion. Small bodies of ore have been found in several properties, and two important strikes have been made in the East Tintic Development mine recently. The Tintic Standard has just purchased ground adjoining the Development company, and will inaugurate an active campaign of development at once.

A large block of the Ohio Copper stock may go to the Cole-Ryan interests. It is known that F. Augustus Heinze's holdings in this property, amounting to the control, have been offered to Cole-Ryan at a nominal figure. The mine has a fine showing from the tunnel level at 1800 ft., to the surface, and would afford a splendid opportunity for Cole and Ryan to get a footing in Bingham.

BUTTE, MONTANA.

May Production. — Reorganization. — Minor Companies.

The Butte mining companies produced 26,443,244 lb. of copper in May. The daily tonnage of ore shipped to the smelters and the total pounds of copper credited to each company for the month were:

Companies.	Tons ore.	Pounds copper.
Boston & Montana	3,520	7,656,000
Anaconda	3,580	6,748,300
Butte & Boston	632	1,154,664
Washoe	530	937,570
Parrot	390	655,980
Trenton	430	735,730
North Butte	1,320	3,445,200
Butte Coalition	1,310	3,039,200
Original	550	1,212,200
Pittsburg & Montana	300	626,400
Miscellaneous	100	232,000
Totals	12,662	26,443,244

The ore of the different companies yielded about as follows: Boston & Montana, 75 lb. per ton; Anaconda, 65; Butte & Boston, 63; Washoe, 61; Parrot, 58; Trenton, 59; North Butte, 90; Coalition, 80; Original, 76; Pittsburg & Montana, 72. The figures of production represent 29 working days.

Among more than a score of new mining companies that were organized in Butte several years ago, less than half a dozen passed through the financial panic unscathed. It is notable that those that did continue work were backed entirely by Western capital. Those that depended on Eastern and foreign money were compelled to suspend operations and have not yet been able to resume. The companies that continued work throughout the financial stress were the Tuolumne Copper Mining Co., the Butte & Superior Copper Co., East Butte Extension Copper Mining Co., and the Butte-Balaklava Copper Co. The East Butte Copper Mining Co., which suspended for some months because of general financial conditions, was first to resume operations, having no difficulty in raising funds even while the general depression continued. A number of other companies have been compelled to re-organize in order to raise money. In this class are the big Davis-Daly Estates Copper Co., the Butte Central & Boston Copper corporation, and the Butte-Montana Mining Co.

There are a number among the less important new companies that did a little work and have since passed practically out of existence. Others never got beyond the organization stage, and there is little likelihood that many of them will soon succeed in raising the money necessary to carry on extensive development. The South Butte Copper Mining Co., owner of a group of claims two miles south of Butte, started development and sank a shaft 328 ft. deep, and then transferred its activities to the Corbin district, where it has a bond on the Daphne group of claims. The British-Butte Mining Co. has been constant in its work on the placer beds west of Butte, and is now operating a big gold dredge. The Eagle Mining Co. has been mining north of Butte and shipping good silver ore. The Butte-Continental Copper Mining Co. is one of the new companies that gave great promise when it was organized, but began too late. It owns a group of claims on the continental divide, east of Butte, upon which there is one large and several small veins. At the bottom of several shallow shafts ore assaying 4 to 12% copper was found. Mining men interested in that section of the country believe that the Continental property is on the same series of veins found in Butte and Corbin districts. Among the other companies that never got fairly started are the Butte & Buxton, owner of a large acreage of copper-bearing ground 12 miles west of Butte; the Butte Hill Mining Co., North Butte Mountain Copper Co., Butte & Bradley, and several others owning large acreage far north of the proved district of Butte. Outside of the Butte & Bradley, none of these inactive companies sold much stock. Among the great number of companies organized it is remarkable that not more than two or three actually were tainted with fraud. A number failed to 'make good', but they were honestly conducted, and the people who bought their stock may still realize something. With few exceptions none of the dormant companies have any immediate prospects of raising money for an early resumption of work, resumption depending entirely on a considerable improvement in the copper industry and market.

TORONTO, CANADA.

Cobalt Shipments.—La Rose.—Dreadnaught.—Otisse.—Gillies Limit. —New Mining Law in Quebec.

The increase in shipments from Cobalt noted during the earlier months of the year was well maintained during April, when 2508 tons were sent to the smelters, as compared with 1317 tons in April 1908. The shipments for the week ending May 22 exceeded those of any previous week this year, amounting to 805 tons, from 10 mines. The Nipissing shipped 226 tons, the La Rose 145, and the Right of Way 129. The figures for the first four months of the year are 9530 tons, as against 5697 for the corresponding period of 1908. Owing to the larger proportion of concentrate, the increase in value will be considerably greater. A noticeable feature of the situation is that the number of shipping mines shows no increase—in fact, the reverse is true. Several mines which shipped last year have so far sent out no ore this season. The increase is entirely due to the heavy output of a few leading mines, especially the La Rose and the Nipissing. These conditions are reflected in the stock market, which continues quiet. The April statement of the La Rose company showed an output for the month of 673 tons, of a net value of $110,909, which will give a net profit of $84,115. The earnings of the 11 months ending with April were $969,584. Raises are being made on the main vein. Good ore is being taken out of No. 2 and 3 raises. No. 4 raise was recently started near the main shaft, and the drills are in high-grade ore. A raise has been made 80 ft. from the McDonald adit to the surface, and is now being worked by open-cut. Development has been begun at the Lawson mine, recently acquired by the La Rose, where driving has been started at the 90-ft. level of the Silver Leaf shaft, following a stringer that is expected to lead to the Lawson main vein. The shareholders of the Rothschild Mining Co. of Cobalt have transferred their holdings to the Dreadnaught Mining Co., now being organized in Montreal with a capitalization of $1,000,000. It is understood that they will receive share for share in the new organization, which is putting a force of men to work on the property in charge of E. C. Kingswell. The Chambers-Ferland has purchased the Welsh claims in the Gowganda district, on which some good finds have been made. The property is 70 acres in extent and adjoins the Bartlett area.

At the Otisse, in the Montreal River area, work is steadily progressing, and a large quantity of ore has been got out and is sacked ready for shipment on the opening of navigation. The Elk Lake Discovery has a shaft down 103 ft., and when the 150-ft. level is reached driving will be begun. The Elk Lake Cobalt Mining Co., one of the Hawthorne syndicate enterprises, is installing a plant comprising 5-drill compressor, two 60-hp. boilers, hoisting engine, etc. At the Toledo Mining Co. and Cummings Mining Co. properties, in the same district, small air-plants are being put in.

The plans of the Ontario Government as regards the Gillies Limit and Provincial mines may be changed. Recently they advertised for tenders for a portion of the area to be sold in sections, proposing to retain the Provincial mine. Recently, however, they have received an offer of a large amount, which rumor places as high as $20,000,000, for the whole area, including the Government mine. The precise

nature of the bid has not transpired, the Government continuing to preserve that reticence which has characterized all official dealings with this property. It is admitted, however, that such an offer has been received and is being seriously considered.

A bill embodying sweeping changes in the mining law of Quebec, introduced by Charles Devlin, Minister of Mines, has been assented to by the Legislature. It will have the effect of giving greater security to the discoverer, preventing the blanketing of large areas, and the holding of property undeveloped for speculative purposes, and will encourage capital by doing away with needless restrictions. The bill abolishes the present prospector's license, while recognizing existing rights until January 1, 1910, substituting in its place the miner's certificate, issued on payment of $10. This entitles the holder to prospect on all lands within the Province, whether public or private, on which the mining rights are vested in the Crown. When a discovery is made the prospector must stake the claim, which in unsurveyed territory must not be less than 40 nor more than 200 acres, and in surveyed territory may be from one up to 200 acres in extent. The Department is to be at once notified of the staking, and within four months from the date application must be filed for a mining license. The application must be accompanied with a fee of $10, and an additional sum of $1 for each acre of the claim. The mining license is good for one year, and can be renewed annually on payment of the same fee and acreage tax. Mining land can be purchased at the price of $10 per acre for 'superior' minerals, and $2 per acre for 'inferior' minerals, if at a distance of 20 miles from a railroad. If within that distance, the price is $20 per acre for superior, and $4 for inferior minerals. Sales are only made subject to the condition that bona fide working of the mine will be commenced within two years, and the patent will only be issued after $500 has been expended for every acre purchased. The sale may be set aside if these conditions are not fulfilled.

JOHANNESBURG, TRANSVAAL.

Turf Shaft Strikes South Reef. — Conditions of Sinking. — Mining Discussions.—South African Coals.—March Output.

The vertical shaft of the Village Deep (old Turf Mines) has cut what is believed to be the South Reef at a depth of 3756 ft., which closely approximates the calculated figure. At the point of intersection the reef has proved to be very poor. In the mines above, however, it is found that while the South Reef is generally diminishing in value, the Main Reef Leader maintains its grade or even improves with depth. Consequently, the strike of this lower reef, to be made in a few weeks, should prove of great importance and encouragement. The Turf shaft, from which the deepest part of the Central Rand is to be tested and mined, was commenced in July 1906 and followed two bore-holes, reaching the reef in 1901-02. This did much to establish the faith of engineers and investors in the persistent payability of the reefs at deep levels. The shaft is situated 1¾ miles from the outcrop, and is of 7 compartments, with its longer axis at right angles to the strike of the formation. It has been sunk at an average rate of 120 ft. per month with hand-labor, by which means the quickest and cheapest vertical shaft-sinking can be accomplished on the Rand. About 80 natives were empolyed, and 40 holes (30 to 40 in. deep) were blasted, per 8-hour shift.

The Presidential address delivered by Edgar Taylor before the London Institute of Mining and Metallurgy, in which the lack of papers dealing with the subject of mining in any general sense was deplored, has occasioned considerable comment on the Rand. The statement, so unfortunately correct as regards mining in England or in India, with which Mr. Taylor is intimately associated, is not so true of the Rand today. Mining methods and mining economics have been discussed during the past year with peculiar thoroughness.

Since the Chemical and Metallurgical Society added 'Mining' to its title, many papers dealing with underground problems and routine work have been read by its members. The S. A. Association of Engineers has also been dealing with mining questions, pure and simple, and even the Transvaal Institute of Mechanical Engineers has been competing in the effort to draw papers and discussions from mining men. Although mining costs in the Transvaal are equal to twice reduction costs, there are certain obvious reasons why the metallurgists and mechanical engineers have in the past been more liberal with their information. From the complex nature of things, there follow more opportunities for change and innovation in surface departments, and there can be nothing more liable to inspire members of technical societies to address their fellows than the discovery of some new scheme of general applicability. The mining man, to succeeed, must be full of new ideas and must perceive many openings for improvement, but most commonly these ideas and improvements apply to the particular conditions under his control, and to the minutiae of routine duties. In the case of blasting problems, which concern all mines alike, there has been no dearth of discussion, and all features have been made the basis of debate, from the placing of the hole to the composition of resultant gases. Rand mining men need no special exhortation to make known their ideas, but they hope that Mr. Taylor's efforts may lead to the publication of papers concerning the methods of the many uncommunicative mining companies, whose interests and control are centred in London.

When it was announced that a paper was to be read on 'South African Coals and Their Economies', before the Chemical, Metallurgical and Mining Society, there was reason to hope that a big gap in local technical literature was to be filled. There is no comprehensive description of Soutb African coalfields available, neither as concerns their geological conditions nor their industrial features. The writer of the above paper, Mr. A. Andrews, unfortunately devoted himself almost exclusively to questions of sampling, and he makes us little the wiser on broader questions. The producing districts of South Africa may be roughly classified as those of Natal, Middelburg, and 'Local' (east of Johannesburg). Representative analyses for these districts are given as follows:

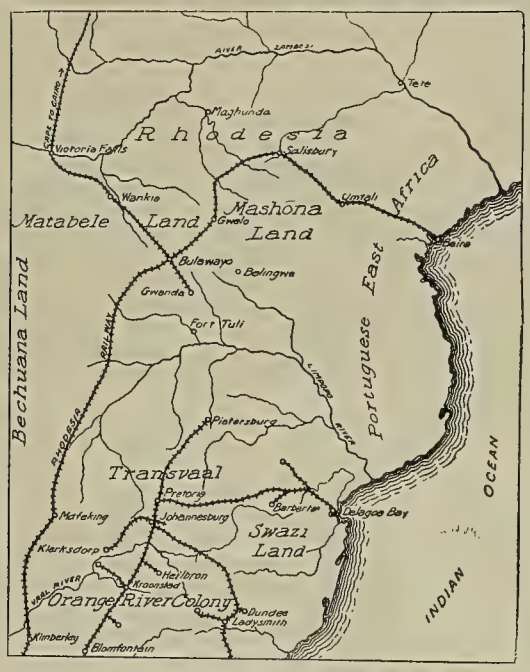
	Volatile matter, %.	Fixed carbon, %.	Ash, %.	Evaporative power.
'Local'	16.64	63.02	18.30	11.69
Middelburg	23.03	61.26	13.91	12.64
Natal	25.03	61.09	11.50	13.29

The percentage of moisture runs from 1.65 to 2.04. It may be noticed that the better the quality, the farther the distance from Johannesburg. Consequently the merits of higher quality in the distant coal is offset by higher transportation costs.

The Transvaal gold output for March was 607,000 fine ounces, valued at £2,580,498. This yield is 8000 oz. below the January record, and shows that the industry has not yet recovered from the results of the recent floods. The production for the first quarter has been £7,594,226, equivalent to just over thirty million sterling per annum. Several mines, however, have been forced to hold up stamps lately. The use of new plants now in course of erection at several points, will raise the output for 1909 to a much higher figure. The greatest single-mill output for March was that of the Robinson, which produced £109,375 from 43,302 tons, operating 210 stamps and 4 tube-mills. The Simmer & Jack came second on the list, with £95,277 from 65,600 tons.

In the early nineties the Transvaal Government granted a concession for the construction of a railway from Komati Poort, a station on the Delagoa Bay-Pretoria line, then in process of building, to Leydsdorp, with the commendable idea of doing away with transportation difficulties. The history of the concession is not a savory one, and some of its promoters were afterward condemned to imprisonment in Belgium in connection with the financing. However, the line was surveyed, and completed to a considerable distance, before financial trouble arose, leading to a cessation of work. Then the Anglo-Boer war supervened. Since then, though earnest pleas have been made to the Government to complete the railroad, and so enable the Murchison range to be

exploited, steady refusals have been encountered. Only a small amount would be required, even to extend it northward to join with the Rhodesian railway system, for the principal engineering difficulties have been overcome. The Government is steadfast, and the line appears doomed to dismantlement, for not long ago instructions were issued to pull up the permanent way and lay the rails on the newly authorized Lydenburg line. The main objection to the completion of the Selati railroad is political, even though the contention be admitted that the stretch of country which it has so far penetrated does not offer much promise of railway revenue. The completion of the line would enable Zoutpansberg to import all its requirements direct from Delagoa Bay, a foreign port, at a cheaper rate than by way of Pretoria or from Durban and Cape ports, as at present. As a matter of fact, the Central South African Railways (the Transvaal railway system) would enjoy a longer run, but merchants at Pretoria and Johannesburg, the two chief inland distributing centres, and the coast interests, are vitally concerned in opposing the line. This objection adds redoubled force to the broader controversial point that, politically—which after all is to an important degree commercially—British South African ports ought to be protected, as against the geographical advantage possessed by the Portuguese harbor.



Map of the African Goldfields.

The present transport system in Zoutpansberg is slow and crushingly expensive, and till it is replaced by railway facilities the district cannot hope to go ahead. Endeavors have been made to persuade the Government, in view of the weight of opposition and its own lack of sympathy with the Selati line, to continue the Pretoria-Pietersburg railroad toward the rich copper fields lying adjacent to the Limpopo. Subsequent connection with the Rhodesian Railways at West Nicholson would create a trunk line running from Cape Town and other Cape and Natal coast ports to Broken Hill, in northwestern Rhodesia. A railway association, under influential local auspices and supported by the few mining companies in the district, has been formed in Zoutpansberg, with the object of impressing on the Government the vital needs of communication.

The Murchison range meanwhile lies deserted. Many examples of past mining industry testify to its former state of activity. The fields unquestionably offer rich opportunities to syndicates and tributors of small capital, such as have established themselves within the past two or three years in Rhodesia. Among the largest holders of claims in Leydsdorp division today is the H. E. Proprietary, but thousands of claims pegged many years ago are still retained by hopeful licensees.

Klein Letaba, lying to the north of Leydsdorp, was also a centre of some importance as a goldfield contemporaneously with the Murchison range. Among other properties which at one time extracted the precious metal and proved its existence in quantities, but which from exactly the same causes as the Murchison range eventually had to close down, were the Birthday, Ellerton, and Eclipse. At both these centres today may be seen valuable machinery under the supervision of caretakers, waiting patiently for the railway which will again enable shareholders to resume work. The only property at work in Klein Letaba at present is the Louis Moore Gold Mines, Ltd., a small-capitalized Johannesburg concern, which, it is understood, has earned encouraging profits.

It is unquestionably copper which in Zoutpansberg lays chief claim to attention. Over a wide area south of the Limpopo river this is to be found in quantities. Extensive old native workings first attracted notice. As the remoter parts of the district were penetrated, these evidences of ancient industry, taken in conjunction with indications of copper-bearing rock, led to closer investigation. It was only in the latter part of the Anglo-Boer war that any serious attempt to work was made. A concession was then obtained over a large area of ground on the farm Berkenrode, close to the Limpopo river, by John Grenfell. The syndicate formed was later floated into the company known as the Messina (Transvaal) Copper Mines. Stories of ground carrying ore-bearing lodes over a wide stretch in the vicinity of Berkenrode soon after came to hand, and today it is established that nearly the whole of North Zoutpansberg is copper bearing. Numerous syndicates and companies have done a lot of prospecting, notably the M'Tamba Syndicate, a concern owning 1284 claims; the Davidson-O'Shea Coppers, the Stratan Syndicate, and the Seclif-Fischer interests. But it is only the Messina which has gone beyond this stage, and which for some time past has contributed a monthly output of 100 tons. The figure is not large, it is true, but few know the difficulties this company has to contend with. Berkenrode is 150 miles from Pietersburg railroad; all its ore is bagged and sent this distance by donkey wagon transport—the local means of conveyance—at a cost for the return journey of £4 to £5 per ton, the time occupied in to Pietersburg being 14 days. The ore has then to be unloaded and shipped to Delagoa Bay, another 500 miles, and thence to Swansea for smelting. This will afford an idea of what the richness of the ore must be to enable such expense to be incurred and yet leave after extraction process a good working profit. Naturally it was only practicable at first to ship the richer grade, the lower quality being reserved for treatment when circumstances should permit. A few months ago, however, the directorate considered that the state of the mine development justified the erection of a concentrating plant. This has now been installed, and the second quality ore is being shipped after reduction. The mine has been developed on thoroughly sound lines.

It must not be thought that the Messina is the only rich spot in the northern copper region; the limited amount of work done on many other properties, but with less financial support at their call, has shown that the area offers large possibilities to the capitalist, and that several Messinas are only awaiting development. What, however, is crippling these syndicates—a difficulty which only by extraordinary commercial pluck the Messina partly copes with—is the old trouble, namely, lack of railway facilities. Though copper has been principally found in North Zoutpansberg, well defined discoveries have been made in other parts of the district, while Waterberg, in the west, and the Motale fields, though even less explored than their larger neighbor, carry undoubtedly as rich deposits as the Zoutpansberg Limpopo beds. If sufficiently powerful financial interests can be found to exploit the copper region, the provision of railroad communication cannot long be resisted—indeed, there is reason to believe that the current endeavors are not proving wholly fruitless.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Chrome ore is used principally in making ferrochrome alloys and for hardening steel, usually in combination with nickel in the manufacture of armor plates. It is also used in the paint industry, and for fettling copper furnaces.

Hardened copper has probably always been rare. There is no indication that the ancients controlled the art of producing it. A few relatively hard copper utensils have been found, but it is manifest that then, as now, such results were accidental and could not be reproduced at will.

Copper refining electrolytically requires 12 to 15 amperes of current per square foot of cathode surface. The voltage is increased with the number of tanks in the series. The loss increases with high pressure of current, hence a large number of tanks may not be advantageously connected into one series, supplied by one feed wire.

Iron pyrite, even when non-arsenical, is not in demand on the Pacific Coast. Sulphuric acid in the West is now a by-product; the difficulty is to find a market for what might be turned out by the copper smelters. Pyrite is not therefore in request, on account of its sulphur, but if containing copper or precious metals it would be marketable as an ore.

Cinnabar, the chief ore of quicksilver, is readily decomposed by heat, giving off, when retorted with lime, mercury, sulphur dioxide, and calcium sulphide and sulphate. While simple in theory, the practice is difficult, especially with low-grade and impure ores. Those carrying over 4% may be handled in small retorts, but furnaces such as the Hüttner and Scott are necessary for treating those of lower grade.

Mica-trap, or lamprophyre, is an igneous rock, occurring usually in narrow dikes, unaccompanied by tuffs. It is fine-grained and dark in color; it alters readily, and inclines to spheroidal weathering. Abundant brown mica is the porphyritic constituent. Those consisting chiefly of orthoclase and biotite are called minette; those in which the triclinic feldspars predominate in the base are known as kersantite.

Fuel briquettes are usually unsatisfactory, owing largely to their tendency to disintegration while burning. This produces a quantity of fines which partly chokes the fire and partly passes off as unconsumed dust in the draft. The ideal briquette would be one which would exfoliate steadily during combustion. Efforts to produce such a form have been partly successful, but the cost of manufacture has been excessive.

Lead silicate is decomposed in the presence of glowing carbon and of a more stable base, such as FeO. This reaction will occur at moderate temperatures. At high temperature the acid lead silicate is broken up by the CaO, the PbO being set free. This will be promptly reduced to Pb if a proper reducing atmosphere be maintained. FeO is efficacious in reducing PbO from its combination with silica, even when present in the form of basic or neutral silicates.

Quicksilver faces a decreasing demand, because of changes in metallurgical processes and decrease in hydraulic mining. The more economical methods now applied in the mills also decrease the waste. On the other hand, the actual number of amalgamation mills has increased, and development of the use of the material in making vermillion offsets to some extent the decreasing metallurgical demand. The California output has remained practically constant for twenty years.

Barium in the form of baryta ($BaSO_4$) is a common accompaniment of lead ores. It is partly reduced to the sulphide in the presence of glowing carbon, and partly through the action of FeS or of metallic iron it is converted into barium silicate, which makes a quite fusible double iron-barium silicate. Much of the baryta enters the slag as a mechanical mixture, without chemical change. As much as 10 to 15% BaO may be driven into the slag. Some barium, as BaS, will also enter the matte.

Tungsten is derived from wolframite, a tungstate of iron and manganese, and scheelite, a tungstate of calcium. Both occur generally in quartz veins cutting silicious rocks, such as granite and rhyolite. Near Deming, New Mexico, scheelite occurs with hübnerite (manganese tungstate), pyrite, and galena in a vein cutting limestone. Near Nome, Alaska, scheelite is found in gold placers in schist. These seem to be exceptions, and in general, search for tungsten is most likely to be rewarded in areas of granitic rocks.

Tridymite is a form of quartz, crystallizing in the triclinic system, but affecting hexagonal symmetry. It is readily recognized by its occurrence in thin, six-sided, colorless tablets, often arranged in stellate groups. It is found only in volcanic rocks of extremely acid composition. It is most characteristic of trachyte, the slab-like forms of that rock being especially likely to contain it. Rhyolites and some few andesites carry tridymite. This mineral is supposed to represent separation of excess silica deposited through the influence of a mineralizer. It is sometimes found accompanying silver ores in Mexico.

Sintering flue-dust and fine ore is practiced to some extent as a means of preparing these materials for smelting in the blast-furnace. Briquetting is also resorted to, using slime, or lime as a binder. Neither method has yet been made universally satisfactory. A large percentage of the sintered or briquetted material is reduced to a pulverulent condition before it has sunk deep in the furnace, and much of it is repulverized in the handling incident upon charging it into the furnace. Both processes are successful with certain ores, depending on their composition. Another method of preparing fines which has been tried consists in mixing them into the stream of reverberatory slag during the skimming of the furnace.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Cost Sheet for Mines.

The Editor:

Sir—In an earlier issue I presented various forms of reports and statements for the mine superintendent, and while many may consider these to entail too much time for such simple transactions as occur in mine-finance, it is an undoubted fact that more publicity will hereafter be demanded in reporting such operations. It behooves one to fall into line. This may be the means of weeding out wild-cats and in promoting more sound interest in mining. Investors are beginning to appreciate the difference between mining ventures run by irresponsible promoters and concerns managed by mining engineers. To reassure the public and to gain its confidence, publicity is necessary. The shareholders at least should be informed of all operations conducted at the mine, and the data should be presented in such shape that ordinary business men may see at a glance both the financial and industrial condition of the mine.

I propose that a cost sheet and report such as is given below be made monthly or annually, according to the extent of the operations. At all events, such a report should be at the head office each month. The bullion, concentrate, and cyanide sheet, and the value of the product, each company must have. Looking over the annual reports of many mines, I find much of importance is omitted, such as the amount of mercury lost. Too many of the important items of expense are ignored, while some take particular pains to dwell upon unimportant figures. Labor and power are the most important expenses, and these should be watched carefully. In case of a change of system the old figures are needed for a comparison. In estimating the proportion of power consumed for different operations, when the power is all generated in one plant the theoretical amount needed for the various operations may be figured and the power used divided proportionally. For example, suppose we assume the average depth from which the ore is hoisted to be 2000 ft., the weight of skip and rope at a ton, and the mill to be of 20 stamps, and with no machine drills in use. Working this out it will be found that the power for hoisting will be about half of that necessary for the mill. Each individual case must be worked out according to conditions such as depth of shaft, weight of skip and rope, amount of water pumped, and the details of the mill. The figures will only be approximations, but will serve to distribute the cost of operating.

Shall the figures per ton in the cost sheet be based on the number of tons mined or the number of tons milled, or both? The South African method is to compute the figures on the number of tons milled, but so long as we have the figures before us on which to compute, I think the mining and milling may as

MINE REPORT FOR YEAR.

Waste rock mined and hoisted	6,000 tons.	
Ore mined and hoisted	40,000 tons.	
Ore milled	35,000 tons.	
Ore ready for stoping, last report	250,000 tons,	value $11.42 per ton.
Ore ready for stoping, this report	350,000 tons,	value $10.12 per ton.
Increase (or decrease) in available ore	100,000 tons.	
Total value of ore milled and mined	$39,390	
Net profit per ton, $3.90. Total net profit	$196,000	
Value recovered by amalgamation	$9,000	
Value of ore shipped to smelter	.....	
Value of concentrate, 150 tons at $100. Value of cyanide product	$15,390	

DETAIL COST SHEET PER TON OF ORE MILLED OR MINED.

Mining, $1.98:	Labor.	Power.	Explosives.	Timber.	Steel.	Repairs.	Sundries.	Loss.
Prospecting	0.005	....	....	....	....	....	....	....
Development	0.55	....	0.15	....	....	....	....	....
Stripping	....	....	....	....	....	....	....	....
Hoisting, tramming	0.14	0.406	....	....	....	....	....	....
Ore-breaking	0.52	....	0.152	0.03	0.017	....	0.066	....
Totals	1.215	0.406	0.302	0.03	0.017	....	0.066	....

Milling, $5.67:	Labor.	Power.	Iron.	Hg.	KCy.	Zn.	Lime.	Repairs.	Sundries.	Loss.
Crushing and elevating	0.10	0.10	0.02	....	....	....	....	....	0.7	....
Stamping and amalgamating	0.32	0.45	0.03	....	....	....	....	0.06	0.06	15%
Concentrating	0.23	0.03	....	....	....	....	....	0.02	....	10%
Assaying, sampling	0.31	....	....	....	....	....	....	....	0.004	....
Sliming	....	....	....	....	....	....	....	....	0.13	....
Cyaniding	0.35	0.12	....	....	0.31	0.35	0.05	....	0.05	5%
Totals	1.31	0.70	0.05	....	0.31	0.35	0.05	0.08	0.944	....

Smelting, $0.05:	Labor.	Power.	Fluxes.	Freight.	Charges.	Repairs.	Sundries.	Loss.
Concentrate	....	....	....	0.02	0.03	....	....	5%
KCy slime	....	....	....	....	....	....	....	....
Executive and General Expenses, $0.118	0.10	....	....	....	....	....	0.018	....

Grand total, $7.525.

well be considered separately, that is to say, estimate the mining cost on the number of tons mined, including the waste, and the milling cost on the number of tons milled. An objection to this appears at first sight, and that is the difficulty of estimating the amount of ore broken but stored in the mine for filling of stopes. In the cost sheet here proposed the figures are on the number of tons milled. It may be that some of the items could be segregated, such as prospecting and development, in which case they could be joined by a brace.

For different conditions the form will need a different arrangement, but should always be so as to give everyone concerned with its operation a clear idea of what has been done, and to give the management detailed costs.

ALGERNON DEL MAR.

Randsburg, California, May 10.

Mine Inspection and Geological Surveys.

The Editor:

Sir—As I understand your editorial of last week, under the above caption, your position favors a continuance of the prevalent method of administering mine inspection. You manifestly disapprove the tendency to place that work within the jurisdiction of State Geological Surveys. You have hinted, but have not broadly stated, that one of the pitfalls which threatens the efficient enforcement of this kind of police regulation—which mine inspection essentially is—consists in the appointment of young technical graduates, lacking in experience of practical mining. That peril follows administration of the service, whether by bureaucratic or by political methods. The politicians invariably have sons or nephews of their own, or the sons or nephews of friends and henchmen, to care for, and in seeking the appointment of such men they can count upon adding the lustre of eminent respectability through endorsement by the professors at the young men's Alma Mater.

The position of mine inspector is a difficult one to fill properly, and I can say, without fear of refutation, that it seldom has been filled properly in this country. The incumbents have often been better than the position. When the regulations are farcical, inspection becomes a farce, and the inspector an actor in burlesque. There is not in any State today a body of regulations that represents the accumulated knowledge of the Europeans as to what is necessary for efficient police control of safety in mining, nor has the original wisdom of the Americans expressed itself in a new brand of 'dont's' sufficient to cover the case. I do not agree that our "politically chosen inspectors" have been "generally successful." They may have succeeded in enforcing a few disjointed regulations so as to avoid an avalanche of political wrath, and some of them have even encouraged reform in matters beyond the range of existing statutes; but they have had no opportunity for successful inspection, because they had inadequate authority. Several coal-mining States have somewhat elaborate regulations, but as a people we are just awakening to the things that should be done to protect the health and lives of miners. The regulations in those States which contain only metal mines are yet more farcical, and there is no agreement among the States tending to establish standards in matters even of such vital importance as hoisting signals. For example, in both Colorado and Idaho the signal 3 bells means 'men on', this to be followed by the signal for hoisting or lowering, and yet in Idaho there is a station signal, '3—1' bells, signifying 'Station No. 6'.

The American Mining Congress appointed a Committee on Prevention of Accidents in Metalliferous Mines, which will report at the coming session in Goldfield. This should constitute a basis for uniform legislation, if the analysis of requirements found useful in other countries shall prove to have been made in sufficient detail. A consideration of the qualifications and manner of appointment of inspectors should engage the attention of the Congress at the same time. You have pointed out a danger of combining the function of inspection with geological surveys. You have also indicated the need of practical men for the service. Those are proper and useful suggestions, but your claim that political appointment is advantageous and generally attracts men endowed with qualities of leadership must be challenged. The American people are respectors of the law; let the statutes be clear and mandatory as to details, and the inspector need risk none of the compromises involved in leadership; he need only administer his office with tact, and efficient inspection will result. For supervision of this kind the route to appointment should be competitive examination, coupled with requirements as to previous experience in practical work, with continuing examinations to demonstrate competency in the face of the growing complexity of modern practice.

REFORMER.

San Francisco, May 29.

Transportation and Coal Mining.

The Editor:

Sir—I have been much interested in the pertinent editorial appearing in your issue of May 8 on 'Transportation and Coal Mining.' In my opinion, it is regrettable that the 'Commodities Clause' of the Hepburn bill was found not to be constitutional. It is certainly an unfortunate state of affairs when a common carrier is both a producer and seller in the markets to which it is transporting the goods of competitors. This condition invariably brings trouble whether the business is well organized or not. I feel tempted to question the statement about anthracite mining formerly being unprofitable. It may be true that in times past, this was the case for 'outside' miners, although even that is a question when you consider the fortunes made by Coxe and other independent producers. However, if it is granted that to the majority the business was unprofitable, what can you say of the railroads, that transported not only their own coal but that of their rivals at prices upward of a cent per ton-mile? Contrast this with the charge made for hauling bituminous coal from southern Illinois to Chicago, one-quarter to one-third

cent per ton-mile. On this rate, the Chicago & Eastern Illinois road was built up and made large profits, and in the past few years four or five railroads have developed lines through this territory to obtain a share of the business at these low rates. Making due allowance for costliness of construction, does not this indicate that the anthracite roads have made and are still making so much out of their hauling that they can well afford to keep the price of anthracite f. o. b. cars low and in this way keep out independent operators? It is a remarkable fact that combination between the anthracite roads in fixing prices has received no check, while such combinations have been so frowned upon in the bituminous fields.

You clearly point out one difficulty that the miners of bituminous coal meet with, particularly in the Middle West; namely, that the trade is a constantly fluctuating one, not only by reason of business, but by reason of the season, everything being arranged for the maximum demand. When a railroad mines only part of its supply, this accentuates the condition. The managers naturally desire to keep their mines running steadily throughout the year, and so provide capacity for the minimum demand. They buy the excess necessary in certain seasons, and unfortunately their greatest demand comes in winter when the commercial mines are already crowded with orders. As a railroad must have coal, this produces complications and frequently coal has to be confiscated. Thus a great contrast results; the railroad mine running every day in the year, the commercial mine practically not running at all in the summer months. This makes it difficult for the commercial mine to keep good miners or indeed any at all. On the other hand, it enables the railroad company, even with indifferent mine-management, to mine its coal at low prices, and having no sales department and general management to maintain, the result is that when the railroad does go out to buy coal, it fixes its price at a point at which the commercial mine often loses money. I therefore think that, with any sort of respectable management, a railway manager can always mine his coal at less than it can be purchased; unless the producer sells at a loss. This condition is very unfortunate, not only for the producer, but for the small consumer, who, in the long run, must pay enough more for his coal to balance the low price of the railroad coal.

Another minor point I venture to question: that the mining of coal by the railroad "eventually leads to selling coal because of the necessity of disposing of certain sizes or grades not wanted by the railroad." This can be taken care of as proposed to be done by the Chicago & Northwestern railroad; namely, by the erection of washeries so that the small sizes of coal can be washed, and in this way put in condition to be used either on switching engines or at stationary plants. If this system were carried out by the various roads, and if they would either voluntarily or otherwise mine all the coal which they need, it would take a very undesirable purchaser out of the market, and would place the railroad mines in the same position as the commercial mines as far as running was concerned. In this way, business would be put on a more stable basis. That it would be difficult for the anthracite roads, and to a lesser extent the bituminous roads, to withdraw from the mining of coal for the open market is no doubt true, but it is a pity that some way cannot be found to accomplish this, in view of the good that would be done to the coal business throughout the whole country.

So far as the unfortunate condition of the bituminous coal business is concerned, I believe that there is one remedy aside from general consolidations; namely, to increase the difficulty of opening new mines by surrounding them with certain restrictions which would tend to safety and also aid in saving the coal. To be done effectively this would have to be accomplished by Federal laws. As to the possibility of this being brought about by considering coal mining as interstate business, I will not venture an opinion, but that the results would be advantageous, I think cannot be questioned. It would give stability to the business, and by restricting the opening of mines, prices would be naturally improved. The gain from an economic standpoint to both life and property would be well worth while.

GEORGE S. RICE.

Pittsburg, May 19.

How It Strikes an American.

The Editor:

Sir—The letter of Edward Walker and your comments on same, in your issue of May 15, are likely to give a false impression as to the Transvaal mining laws; that is, unless they have been altered since I was there. I think that the reason that the directors of the Cinderella Deep had to get permission to increase their force of underground workers is that the Cinderella Deep has only one shaft and its workings are not connected to those of any of its neighbors. The laws of the Transvaal prohibit the working of a property which has not more than one means of ingress and egress. This prohibition is often relaxed by permission of the State Mining Engineer and under conditions imposed by him.

FRANCIS DRAKE.

San Francisco, May 17.

Salt is classified according to the amount of refining, the methods employed in refining, and the purposes for which the salt is used. The grades are 'table and dairy', which includes the extra fine and fancy grades prepared for dairy and family use, and all grades artificially dried; 'common fine', including all other grades of first quality not artificially dried; 'common coarse', including all grades coarser than 'common fine' made by artificial heat; 'packers', 'solar', 'rock', 'milling', 'brine', and 'other grades'. 'Packers' salt is that prepared for the purpose of curing fish, meats, etc. 'Solar' salt is that made by solar evaporation. 'Rock' salt includes all salt mined and shipped without special preparation. 'Milling' salt is used in gold and silver mills. Under 'other grades' are included the low-grade products used for salting cattle and for fertilizers, etc. 'Brine' includes all salt liquor used in the manufacture of soda ash, sodium bicarbonate, sodium hydrate (caustic soda), and other sodium salts or brine sold without being evaporated to dryness.

DREDGING AT OROVILLE.

Written for the MINING AND SCIENTIFIC PRESS
By DOUGLAS WATERMAN.

The Oroville district, California, is an interesting field for studying the various types of dredges and details of operation. There are two distinct types of boats in use. The Risdon type, the oldest in the district, is characterized by an open-connected bucket-line, revolving screen, bucket-stacker, and head-line. The Bucyrus has close-connected bucket-line, shaking or revolving screen, belt-conveyor, and spud. The respective merits of the two is a fruitful



Fig. 1.—Bow-Line Roller Showing Wear.

field for discussion. Each has its champion, with argument that seems convincing—until you talk to the other man. It is indeed difficult to draw comparisons from a yearly record of costs and cubic yards excavated, for the reason that no two boats work under exactly the same conditions; the varying character of the gravel, the age and condition of the boat, and the personal equation of the operatives, are factors which must be taken into consideration. There is a growing tendency among the dredging companies of California to design their own boats, the contract being given to some large manufacturer of dredging machinery; thus we find the Link-Belt, the Marion Steam Shovel, and the Bucyrus compa-

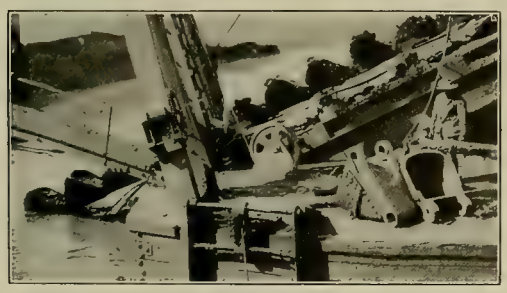


Fig. 2.—Fair-Lead on Boats of Oroville Dredging Co., Ltd.

nies furnishing machinery for boats that combine the best features of both types. This is proving highly satisfactory. As regards the relative merits of the distinctive features of the two types of dredges, the result of my observations is as follows: The shaking screen gives good service where the material is loose and easily washed. On the Pacific boats, the Butte, and others working in loose river gravel, almost free from clay, the shaking screen is entirely satisfactory. The revolving screen is efficient, no matter what may be the character of the gravel; there is no disputing its superiority over the shaking screen when the gravel is cemented or sticky. The character of a deposit often varies in different parts of the same tract; moreover, the extent of induration, or the proportion of clay, is not always revealed by the prospecting necessary to prove the value of the ground. Therefore the safer course would be to provide the boat with a revolving screen that would meet all conditions. The Oroville Dredging Co., Ltd., operating eight boats, has both types of screens. The shaking screen on one of its boats has recently been replaced by one of the revolving type, at an expense of $10,000. I am assured by the management that the new boats will be provided with revolving screens. It is a difficult matter to compare the cost of up-keep and lost time with the two types of screens, since the reciprocating parts of the shaking screen may cause unnecessary stoppages through lack of proper attention. The fact that the rolling parts of the trommel require little attention is an argument in its favor. The revolving screen on California No. 3 is a departure from the usual form of washing apparatus. It is telescopic, with three 10-ft. sections, the diameters of which are 6 ft., 5 ft. 4 in., and 4 ft. 8 in., respectively, the largest being at the head, where the greatest screen area is needed. The 4-in.



Fig. 3.—Fair-Lead on Boats of Oro Water, Light & Power Co.

shoulder between successive sections has a retarding influence on the passage of the gravel through the screen, allowing ample time for thorough washing of the material before it is discharged. Manganese rings, 4 in. diam., are placed inside the screen against the shoulder, which is the point subjected to the greatest wear. Longitudinal strips of steel, ⅝ by 1½ in., are riveted inside the screen. In the largest section there are 24 strips, spaced 8 in. between centres. These strips serve to mix the material as the screen revolves, thus greatly assisting the washing process, as well as the disintegration of the gravel. They also prolong the life of the plates if shifted from time to time, as the portion of the screen under the strip is for the time being protected. As the strips are 1½ in. wide, with 6½ in. of uncovered screen between them, they may be moved four times to a new position on the plate. The strips therefore receive one quarter of the wear, and the life of the screen is increased proportionally. One set of plates in this screen has lasted three years.

While the majority of the operators at Oroville favor the spud, I am of the opinion that equally good work may be done by digging on a head-line. One

argument against the head-line is the surging of the boat, which makes it difficult to hold her nose against the bank. From my observations I judge the intermittent bucket-line, which is found on most boats using the head-line, to be the principal cause of the trouble. The time lost due to changing the head-line, and to stepping ahead with the spud, are about the same. A 5-ft. boat has been digging on a head-line since the spud was broken some months ago, and there has been no marked change in the yardage. At the time of my visit I observed no undue surging of the boat. This is really the best test, being made under exactly the same conditions. The ideal boat would be equipped with both spud and head-line; then if the spud should break, or the winch-men were less familiar with its use, the head-line could be brought into service. While all the boats are provided with a winch which could be used for a head-line in an emergency, it is too light for prolonged hard service.

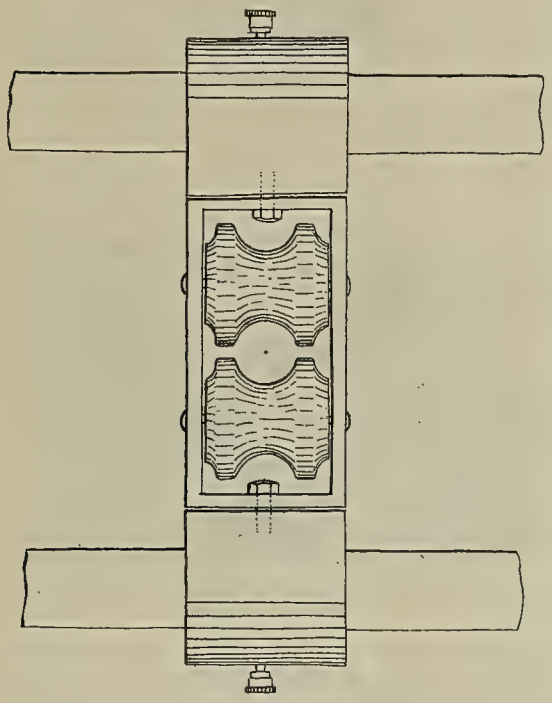


Fig. 4.

The point raised in favor of the open-connected bucket-line is its ability to handle large boulders. The close-connected line will perform the work equally well, provided the buckets are properly designed. The angle of the lip should be flat, so that a boulder will rest on top of the lip instead of being jammed between it and the next bucket ahead, which would crush the hood. To allow room for boulders, the pitch of the bucket, that is, the distance between centres of pins, should be greater than that generally given to buckets of the close-connected type. California No. 3 has a bucket that fulfils the above requirements. This bucket has a pitch of 35 in. and a lip-angle of 45°. I am told that by changing from a 5-ft. open-connected to a 3½ close-connected bucket-line, the yardage was increased 30%, and the power bill decreased 25. It is hard to conceive of conditions under which the close-connected bucket-line would not give better service.

The bucket-stacker is found only on the Risdon type of boat, on which it gives good service. These boats are cut away at the stern to allow the tailing to be stacked closer to the boat. A short stacker set at a steep angle will dispose of the tailing satisfactorily. Spud-boats must have a square stern, and therefore require the tailing to be stacked at a greater distance than is necessary with the Risdon boat. The belt-conveyor is superior to the bucket-stacker under these conditions, as a long stacker may be used without putting an excessive weight on the stern of the boat. As regards the relative economy in the use of the two types of stacker, it appears that there is little difference, either in the cost, which includes original out-lay and expense of maintenance, or in the time lost.

A clever idea has lately been applied at the Boston machine shop, which is expected to double the life of the bucket-pins. They are so constructed that the pin and the lug are separate. The lug is fitted into a machined recess in the bucket-bottom as in the past, and is securely riveted; but it has a square hole cut at the point where it meets the pin, the latter having a square end prepared to fit into the hole in the lug. This allows the pin to be turned half round, giving an equal wear to both sides. These new pins have been in use on California No. 2 for six weeks, and so far have shown no wear at the lug.

Nothing is more noticeable than the lack of care given to the bow-lines on many of the dredges. In some instances the deck-sheave was not turning at all; in others, the cable was cutting into the deck or the two rollers (Fig. 1). This means excessive wear on the steel cable, which is costly. Two excellent styles of rope-lead were observed. Fig. 2 shows the device on the Boston and California boats of the Oroville Dredging Co., Ltd. Fig. 4 shows details. From the deck-sheave the rope passes between the two small spools in the carrier, and thence to the 'dead-man' on shore. As the boat swings on the spud the carrier moves from one end of the guide-rods to the other, the idler frame at the same time turning on a vertical axis to accommodate the change of angle. Fig. 3 shows the rope-lead on the boats of the Oro Water, Light & Power Co. This is less expensive to construct than the one just described, and occupies less space on the deck. The device consists of a sheave hinged horizontally to the deck; a semi-circular track, of which the axis of the sheave is the centre; and a carriage attached to this axis by means of an arm, free to turn about it as a centre. The detail of the carriage is given in

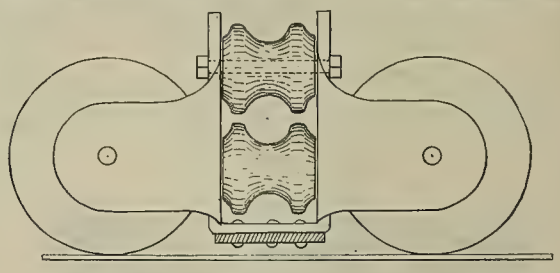


Fig. 5.

Fig. 5. If the rope leads at a sharp angle from the deck to the bank above, the carriage is lifted from the track, resuming its position when the lead is downward instead of upward. A possible improvement in the form of the carriage suggests itself, namely, the substitution of small sheave-wheels for the spools, which would decrease the bending-angle, and lessen the wear on the cable.

The importance of reducing to a minimum the time lost needs no emphasis, yet it is often overlooked by the operators in the daily routine of work. A suffi-



Fig. 6.—Oroville Dredge Showing Overhanging Sluice.

cient number of parts that require constant renewal, such as buckets, pins, etc., should be kept on the boat, ready for instant use. The time that may be needlessly lost by non-observance of this principle was brought forcibly to my attention on a visit to one of the boats. The men had one spare bucket on the boat, which they had just placed in the bucket-line. Another needed replacing, but there was none nearer than at the blacksmith shop, a quarter of a mile away. The day being Sunday, over an hour's time was lost before the teamster could be found and the bucket delivered on board the dredge. A mislaid

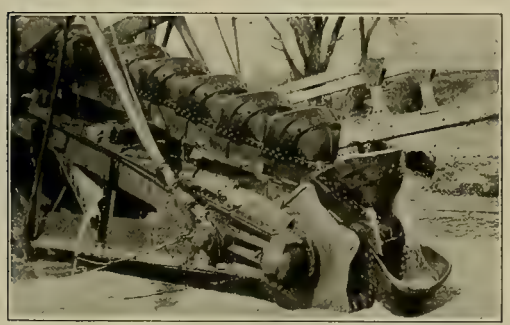


Fig. 8.—Protector for Tumbler-Cheek on Pacific Boats. Indicated by Arrow.

wrench or saw may cause many minutes delay. A clever scheme for keeping track of the tools was observed on the boats of which George Carr is superintendent. An exact reproduction of the various tools was painted in vivid red against the dull lead color of the cabin wall. This was covered when the tool was in its proper place; when missing, the eye was instantly attracted by the painted space.

A bucket-bottom and hood made in one casting is not a new idea. The old Pennsylvania employed such a bucket, but it was unnecessarily heavy and was not looked upon with favor by dredge men in the district. This type of bucket has lately been revived, and I believe that it will supplant the riveted bucket now in use. With the latter, the rivets are continually working loose. Not only do the rivets have to be replaced, but the constant racking of the loosened parts causes serious wear on the bucket, thus adding materially to the cost of up-keep. Leaks occur where the rivets are loose or missing, and loss of gold results. A new cast bucket of 7 cu. ft. capacity was seen at the Pacific shops, which had been carefully designed to combine lightness with strength. The weight of this bucket and the first cost are less than of buckets now in use. The greatest wear on the bucket-bottom occurs on the under side of the rear eye. At the Boston machine shop they are mortising 1 by 6-in. manganese plates into the bucket-bottom to take the wear at this point.

The boats of the Oroville Dredging Co., Ltd., are having the area of their gold-saving table increased by the addition of overhanging sluices supported by brackets to the sides of the dredge (Fig. 6). The tables are divided into three compartments to distribute

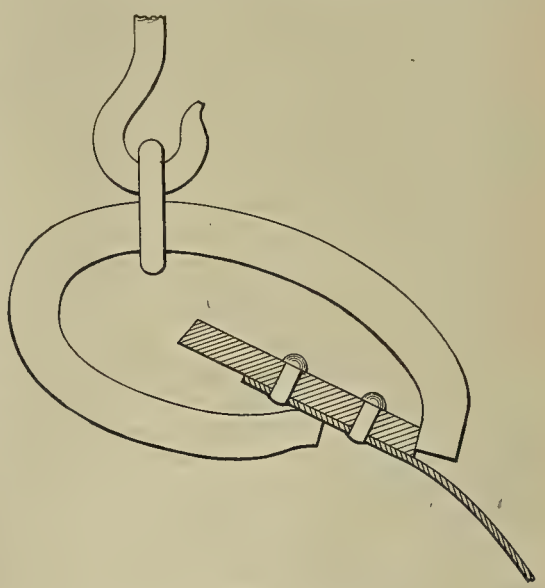


Fig. 7.

the material more evenly. The boats have revolving screens, and the material from the first three gates is directed into these sluices on either side. The sluice-area, which was formerly 1200 sq. ft., has, by the addition of these outside sluices, been increased to 2000 sq. ft. While the percentage of gold lost in dredging is in most cases small, the saving effected by increasing the sluice-area and by installing better washing apparatus would justify the outlay.

The latest dredges at Folsom are provided with a double bank of sluices, which require a larger boat and longer bucket-line than is found in the Oroville field. All the available space inside the boats at Oroville has been utilized for tables; the introduction of outside sluices has gone far toward solving this problem. There is another advantage to be gained by increased sluice-area in addition to the increase in amount of gold saved. Many of the dredges working in loose river-gravel are running below their

capacity owing to a lack of sufficient sluicing area. To cite an actual case: a boat digging in river-gravel has ample screen-surface, but is limited as to sluice-area. It is now averaging 40,000 cu. yd. per month, which could be increased to 50,000 cu. yd. The cost of handling 40,000 cu. yd. is $2500, and at this rate the cost of 50,000 cu. yd. would be $3125. The monthly saving effected by increasing the yardage to 50,000 would be $625, less a slightly increased power-expense.

The Boston machine shop is employing the Goldschmidt thermit welding process to repair heavy parts of the machinery and the bucket-line. Bucket-bottoms taken from the scrap-pile have been repaired and again placed in service. Broken teeth have been replaced in gear-wheels, and have proved so serviceable that it is the intention of the company to apply the process to the repair of a bull-wheel, broken in three pieces.

A time-saving device for use when changing buckets is the grapple shown in Fig. 7. By this means the chain-block may be instantly attached to the bucket, which is securely held in a position corresponding to the angle of the ladder when raised for changing buckets. The wear on the lower tumbler-cheeks, caused by rocks which have become jammed between the ladder-frame and the tumbler, may be avoided by using a shield made from a piece of old rubber belting, and attached to the ladder-frame as shown in Fig. 8. This device is used by the Pacific boats.

There are a number of features on the various boats which are worthy of brief mention. California No. 3 is provided with an individual ladder-hoist, operated by an independent controller, the advantages of which are: complete control of the ladder when lowering, which is not possible with the friction clutch; no friction band requiring continual adjusting; and the ability to raise and lower the ladder without stopping the bucket-line. This hoist has been in use four years and has not caused one hour's delay. California No. 3 also has a flat conveyor-belt which has given over a month longer wear than the troughed belts, besides reducing the idler cost. If this conveyor were provided with a 48-in. drum, such as is found on El Oro No. 2, the combination would be ideal. Several of the boats of the Oroville Dredging, Ltd., have an 'A' frame which projects in front of the forward gantry. A chain-block may be hung from this frame directly over the lower tumbler—an advantageous position for handling heavy castings. The traveling crane with which El Oro No. 2 is provided saves much time when changing the upper tumbler.

The amount of water actually required by a dredge is an interesting question, but one that is difficult to determine in the Oroville field, since the majority of boats are either working in the river bars, where no water supply is required, or in ponds connected through the tailing with other dredges. California No. 3 worked for months in such a pond. The proportion of solid matter has reached as high as 60 lb. to the ton of water, the increased specific gravity causing the boat to float one foot higher than its normal draft. This suggests a means for increasing the flotation if the hull be improperly designed, or if heavy parts be added to the dredge. Muddy water is of course undesirable, but the benefit derived from increasing the specific gravity might outweigh the loss of gold and the wear on pumps and machinery. Baggett No. 1 is supplied with 10 miner's inches of clear water. There is a heavy seepage from the dredge-pond through the tailing to a pond at a lower level, from which the clarified water is returned by means of a centrifugal pump. Such a scheme offers possibilities in the way of dredging in countries where water is scarce.

The frequency of the clean-up is important. I was informed by a dredge superintendent that quicksilver could be found in the lower sluices after a week's run, and that it was not safe to run over ten days without cleaning up. When the dredge is started after a clean-up, nothing but gravel should be allowed to pass over the sluices until the riffles have been filled with this material. Sand or clay would pack in the bottom of the riffles and destroy their effectiveness as a means for saving the gold.

Quicksilver Deposit of Huancavelica.—The famous Santa Barbara mine was discovered in 1570. From 1571 to 1908 the output amounted to 51,362 metric tons of quicksilver. During the Colonial period the mine not only supplied the Peruvian mills, but likewise a number of those in Bolivia, Chile, and Mexico. The decadence of the industry dates from 1850, when the Santa Barbara and neighboring hills were practically abandoned, owing, it is said, to the discovery and exploitation of cinnabar in California. The outcrop can be traced from northwest to southeast for a length of 65 kilometres. The width is variable, but at Santa Barbara itself it attains 50 to 80 metres. The formation consists of silicious sandstones, limestones, and calcareous conglomerate, and is dislocated and folded, the strata sometimes dipping northeast and sometimes southwest. Andesites and basalts have intruded this formation, and surround the mercurial deposit throughout nearly the whole of its extension. At the Cerro Santa Barbara, sandstone is impregnated with quicksilver; elsewhere it is in the form of thin stringers in the fissures of limestones or among the conglomerates. The sandstone is impregnated with cinnabar and native quicksilver, as well as with galena, blende, pyrite, and arsenopyrite. The distribution of the cinnabar is quite irregular, but there appears to be a relation between the richness and the andesitic intrusion.—The Mining Journal.

The Belgian steel works of the Cockerill Co., in Liege, have just started an electric-furnace, which is described by G. H. Albert Johnson. The furnace is built on the Girod system, with one electrode, and has a charging capacity of from two to three tons of steel. The dynamos furnishing the necessary electric current—an alternating current of 50 volts—are operated by gas motors, utilizing the gas from the blast-furnaces. The electric furnace is placed in a building in close proximity to the steel converters, with which it is connected by a traveling crane, with a truck for transporting the ladles to the converters.

EARLY COLORADO DAYS.

Written for the MINING AND SCIENTIFIC PRESS
By GEORGE W. MAYNARD.

A comparison of the transportation facilities west of the Missouri river in the sixties and the discomforts of the Pullman car of today will be of interest to the newly-fledged mining engineer who makes his first trip from New York to Denver within three days, with only two nights on the road. Harking back to 1864, when I made my first trip, brings out the rather startling fact that I am almost a pioneer, for the discovery of gold by Gregory in the sands of Cherry creek was first heralded in 1859, five years before. While trying to recall the names of pioneer friends, I am also startled by the fact that the majority have 'passed over the divide'. Of those still with us there are William P. Blake, the Nestor of the profession, R. W. Raymond, then U. S. Commissioner of Mining Statistics, whose work carried on under the greatest physical difficulties will long remain an extraordinary example of reliable information and phenomenal industry, and lastly Anton Eilers, the transplanted German, who may be credited with being the father of scientific smelting in the United States.

Of the first instructors in the Columbia School of Mines the only ones left are the beloved Van Amringe and Chandler. I believe I have included in the list those who date back to the sixties, and have been spared to us because they must have discovered the 'fountain of youth'—which is really a cheerful disposition, an outdoor life, and the doing of things which one loves.

My personal experience was not especially novel for those days, and was probably about the same as that of my contemporaries. In April 1864 I started for Colorado to examine a gold mine in Gilpin county. The route was by the New York Central to Chicago, a journey of about two days, thence by rail to Quincy, Illinois, then by boat to Hannibal, Missouri, and from there by the Hannibal & St. Joe railroad to St. Joe, at that time the extreme western railroad terminus in the United States. That railroad ride across Missouri was an eventful one. It was during the rebellion, when the State was only kept from joining issue with the South by the presence of United States troops. The Hannibal & St. Joe railroad was the only means of transportation from the Mississippi to the Missouri, and frequently changed hands, with consequent tearing up of track and destruction of rolling stock. The condition of the road-bed created the sensation which one frequently experiences between Dover and Calais. On the first night, just before the berths were made up, we were startled by the discharge of rifles, and the smashing of glass on one side of the car. The passengers suddenly became very tired, and reclined on the car floor. The engineer threw open the throttle, and that tired feeling gave place to an expectation of speedily being wrecked. The guerillas must have been widely distributed along the road, for on the following morning, on our arrival at a station, we saw ten or a dozen laid out on the station platform who had been killed by Union scouting parties.

After a night at St. Joe we crossed the Missouri to Atchison, Kansas. The town and the surrounding country were covered with prairie schooners, horses, mules, oxen, shouting teamsters, women, and babies, all headed for 'Pike's Peak or bust'. The overland stage line at that time was owned by Ben Holladay, and the fare to Denver was $125, which did not carry with it a guarantee as to time of arrival. The stage coaches were the well known Concord thorough-brace type. For comfortable riding the stage had to be heavily loaded. Our load consisted of nine persons inside, three on a seat, and four or five on the roof. In addition to this, there was a heavy mail in leather sacks, and considerable express matter at 50c. per pound. The mail for the most part consisted of public documents, and contributed to the profanity of the driver and passengers. In subsequent trips I have frequently seen the mail sacks with their contents used to fill a chuck-hole in order to get over a bad bit of road.

It was my fortune to be the middle man on the back seat, and I had eight days and seven nights of it. The only relief was when we could stretch our legs during the change of teams at feeding stations. The uniformity of the food—fried bacon and hot biscuit, the latter yellow with soda—gave no indication as to whether the meal was breakfast, dinner, or supper; this could only be determined by the time of day. The distance traveled to Denver was 653 miles. The route from Atchison was northwest to Fort Kearney on the Platte river. At the time of our arrival there was an encampment of Sioux and Arapahoes, fully a thousand in all, who had gathered to receive the annual distribution of blankets and food from the Government. There was a large Government wagon-train and a liberal sprinkling of soldiers. On the following June these same Indians were killing people all along the line. On my return trip we frequently had to travel 50 to 60 miles with the same team, because at the relay stations the inhabitants had been slaughtered and the horses and mules driven off. During the eight days and seven nights wagon-trains were always in view, the larger number being drawn by oxen. About three days from Atchison, dead oxen began to deface the landscape and vitiate the atmosphere, and were in evidence all the way to Denver.

I doubt if a shipwrecked crew ever rejoiced more on reaching land than did our load of jolted companions on being landed at the Overland Hotel in Denver. My recollection is that all of our passengers were 'tenderfeet', and they soon began to make remarks unfit for publication, about the rooms, beds, and food, instead of contrasting the eight days' agony with the relative luxury of that hotel. The proprietor, like the historic church organist, was doing the best he could, and really did not deserve to be shot.

The population of Denver was about 2000. The residences were one-story frame buildings scattered apparently without regard to the location of prospective streets. There was but one brick building, the United States Mint, which was in fact only an assay office for bullion and gold dust. It was a great boon to the miner, for there he always got the full

value of his deposit. At Denver myself and companion were so fortunate as to meet James E. Lyon, of the Central City firm of Lyon, Pullman & Towne, who invited us to make the house of the firm our home while in the mountains. With a letter of introduction to Mr. Towne, we were cordially received and cared for during our stay.

The last stage of the journey was the 40-mile drive to Central City. The first 15 miles was across the level country to Golden City, at that time the capital, standing at the base of the foot-hills of the front range of the Rocky Mountains. Then followed the climb through canyons and along the banks of the roaring Clear creek, and over Guy hill, where the road to our Eastern eyes appeared to be little short of perpendicular. 'Jake', the famous driver on the route, guided his six horses with a confidence and ease which elicited hearty approbation from some of our Jehus who had 'tooled' a coach on the level roads of the East.

Pat Casey (a road above town still bears his name) is reputed to have been the first Colorado man to sell a mine in the East, but it is not generally known that the next sale was that of the Gregory Consolidated by Lyon, Pullman & Towne, for $500,000. The Pullman of this firm was George M., who put his third of the money into building sleeping cars, and thus his start in that great business came from a Colorado mine. It is stated that this was his first and only mining venture.

My work at Central City was confined to the examination of some prospects in Eureka and Prosser gulches, in the neighborhood of the Gunnell lode, which had already become celebrated. After visiting many of the principal mines and stamp-mills in the neighborhood, I was so favorably impressed with the general outlook that I concluded to establish a branch engineering and assay office.

On my return journey to New York, I stopped off at Denver, and on the night of my arrival I witnessed a flood which cut a swath through the centre of the town. The flooded condition of the surrouning country delayed the departure of the stage for a day or two. It was on this return trip that we witnessed the ruin wrought by the Indians.

In the following December I started out, with one companion, this time going from Chicago by the Chicago & Northwestern railroad, to Des Moines, the extreme western extension of that road. From Des Moines we staged it to Council Bluffs, and crossed the river on the ice to Omaha. It was our intention to buy a team and carriage and drive to Denver, trusting to be in daily contact with overland wagon-trains. The military authorities at Omaha dissuaded us from taking the risk, on account of the Indians along the road. We therefore took to the Ben Holladay coach, and finally brought up at Fort Kearney, after crossing the Platte partly in a flat-bottomed skiff and for most of the distance by wading through floating ice.

At Fort Kearney we caught the overland stage for Denver. The other passengers were frontiersmen, all armed—in fact, the coach was practically an arsenal. We had a six-mule team and I sat with the driver. When nearing Plum creek he made the rather startling announcement, "There are Indians somewhere around here." "How do you know?" I asked. He answered, "See the way them leaders are acting. A mule can tell when there is an Indian a mile away."

We were paralleling a range of bluffs a mile or more to our right when we saw Indians on ponies bobbing up and down on the other side of the bluff, trying to keep up with the coach without exposing themselves. The driver, who had had some Indian experiences, 'got a move' on the mules, which was a surprise to them and the passengers. As we were approaching a military post west of Plum creek, the Indians gave up the chase. Within about two miles of the post we encounterd a grewsome sight—the wreck of a wagon-train and the bodies of the teamsters, shot to death, and many of them with arrowheads buried in their bodies, and all scalped. One of the men was still breathing; so a member of our party mounted a mule, rode to the post, and returned with an ambulance and surgeon. I learned subsequently that the man's life was saved.

For a part of that winter we 'bached it' in a log cabin in Prosser gulch. On the receipt of the assay outfit, which had been on the road for three months, I established an engineering and assay office, the first one in Gilpin county. There was great activity, both in mining and custom-milling, as long as the gossan ores held out. When the sulphurettes were reached and the values could not be saved by amalgamation, the outlook became gloomy. Then came an epidemic of processes invented by fake scientists who were absolutely ignorant of the first principles of metallurgy, and these not only got a hearing, but money in large amounts, from Eastern men, for the installation of worthless machinery. R. W. Raymond in one of his reports calls attention to "the *outcrops* of process machinery scattered over Gilpin and Clear Creek counties." In the meantime young metallurgists who had been trained in Germany began to arrive in New York, but could not get a hearing on the established methods of ore treatment.

A serious handicap during the pre-railroad days was the high rate of wages and supplies. Miners received $5, blacksmiths $10 and $12, and carpenters the same rate per day. The food-supply was uncertain, for very little was raised in the country, apart from chickens and eggs, and these brought very high prices. All the flour and bacon came from the East. When a snow blockade occurred refuge was taken in canned goods. That the people were able to pull through under these conditions is good evidence of the general value of the ore.

As many of the mines began to produce copper sulphurettes in depth, with increasing gold values, the necessity of resorting to smelting became evident. The nearest coal mines were in the foot-hills north of Golden, 30 miles distant, and, there being no railroad, it was manifest that a smelting plant near the mines would necessarily be restricted to wood for fuel. After many abortive efforts, James E. Lyon built a small reverberatory furnace at Black Hawk, presumably from his own design or from that of a mason. The roof promptly fell in on the first firing;

therefore smelting was declared to be unsuited for Gilpin county ores.

In the summer of 1886, N. P. Hill, professor of chemistry in Brown University, arrived in Central with some students, on a vacation outing. While in Central he passed many of his evenings in my office, and naturally our conversations were for the most part metallurgical. I told him of the German and English methods of treating ores of the same character as those of Gilpin county. He became so interested that he concluded to try to secure capital among his Boston and Providence friends, with the view to erecting a small plant at Black Hawk. I advised him to visit European plants in advance of undertaking the erection of a plant, in order that he might fortify himself by personal observation. I furnished him with the names of the principal plants in Germany and Wales.

The outcome of his investigation was a visit to the Swansea works of Vivian & Co., where Hermann was manager. He arranged with the owners of this plant to loan him Hermann for a period long enough to erect one furnace at Black Hawk. Pending the installation of a chemical laboratory the assays and analyses were made in my office. The name of the company was the Boston & Colorado Smelting Works. The plant was established in 1867 at Black Hawk on North Clear creek. The officials were N. P. Hill, resident manager, Henry R. Walcott, business manager, and Professor Beeger, metallurgical superintendent. Beeger was later succeeded by Richard Pearce. These works were the forerunner of the great Argo plant near Denver; a monument to Richard Pearce's metallurgical ability and untiring industry. The metallurgists of the present day know little of pioneer work in furnace construction.

The opportunity for bringing the mineral resources of Colorado to the knowledge of the outside world presented itself in the exposition which was to be held in Paris in 1867. Meetings were held in Central and Denver, with the intention of trying to impress upon the mine-owners the importance of making an exhibit which would be creditable to Colorado. The miners and mining companies as a whole did not appreciate the importance of such an exhibit, and it was only by persistent entreaties and many a journey by wagon and by saddle, nearly a year's work, that a representative collection of ores was secured. Assays of the typical ores were made without cost to the contributors. The heavier exhibits were carried to North Platte, the then terminus of the Union Pacific, in wagons which were returning to the railway. The most valuable samples were carried by Wells Fargo & Co. without charge. The railroads all the way to New York were equally liberal, with the exception of the New York Central & Hudson River, which held up some cases with a freight bill for $64.

In Frank Hall's 'History of the State of Colorado' the following statement appears in Vol. I: "In 1867 George W. Maynard, a mining engineer, was appointed by Governor Cummings, Commissioner for Colorado to the Paris exposition of that year. The appointee being unable to go, declined, when acting-Governor Hall tendered the place to J. Parker Whitney, of Boston, who being largely engaged in the development of our mines signified his willingness to accept, and also to collect a fine exhibit of rare and representative minerals to be added to his already superior cabinet, and take them to the exposition at his own expense. The effect of this representation was salutary, for it induced many eminent scientists of Europe to make exhaustive examinations of the gold, silver, and other resources of the Territory, whose favorable reports when published caused the investment of much foreign capital in them."

While Mr. Hall is correct as to the final outcome of the exhibit it is not accurate as to the details which preceded the installation. I was appointed Commissioner by Governor Cummings, the engrossed commission was countersigned by the Secretary of State at Washington, and the great seal of the United States was attached. At the time of the appointment the Territorial Legislature was not in session, so that an appropriation for the expenses of the Commissioner and the cost of installation could not be made. It therefore devolved upon the citizens of the Territory to supply the funds. A finance committee was formed, of which George Clark of the banking house of Clark, Gruber & Co. was the chairman. Meetings for the collection of funds were held in Denver and Central with unsatisfactory results.

In December 1866 I left for New York so as to receive the ores on their arrival and arrange for the shipment to Paris, on the assurance that the necessary funds would follow. Shortly after reaching New York I received a letter from Mr. Clark stating that he had been able to raise but $300, and that if I would go to Paris and set up the exhibit he thought an additional amount would be forwarded. This liberal financial proposition was my reason for declining to go. As there were several Colorado men in New York and Boston, who had sold their claims, and others who were working mines in the Territory, I called a meeting at the St. Nicholas Hotel, which was fairly well attended. The only response I got at the meeting was the offer of James E. Lyon to pay the New York Central & Hudson River railroad freight bill if I would turn over the ores to him to be set up in his office. This I promptly refused to do.

My next effort was to get Boston interested. Finally, just as I was beginning to despair of raising the necessary money, J. Parker Whitney, of Boston, called on me and offered to meet all the expense of installation of the exhibit if I would have him appointed Commissioner in my stead. He frankly stated that his proposition was not purely eleemosynary, for he expected that on the strength of his position he could influence foreign capital to invest in Colorado. I immediately took the steps which resulted in the appointment of Mr. Whitney. I do not know if the Territory ever officially recognized Mr. Whitney's valuable services. I furnished him with a list of the ores and the names of the contributors, the mines, and the districts, with condensed descriptions, as well as the assays of the typical samples of ores. Mr. Whitney published a pamphlet in English and French, the title of which is: 'Colorado, in the United States of America; schedule of ores contributed by sundry persons to the Paris Universal Exposition of 1867, with some information about the

region and its resources.' By J. P. Whitney, Commissioner from the Territory.

The pamphlet consists of 7 pages of assays, 66 in all, together with the names of the mines and their owners, followed by subdivided lists aggregating 415 from different districts, each subdivision with the caption, 'Ores Contributed by J. P. Whitney'. Doubtless Mr. Whitney contributed from his own collection some of the specimens, but in checking the lists I find that by far the largest number were contributed by the mine-owners and were packed and shipped from Central City.

In the 'Report of the United States Commissioner to the Paris Exposition' (Vol. II, pp. 44, 45, 46) is the following statement: "Mr. Whitney published a pamphlet in English and French descriptive of the Territory and its resources, with a list of the principal districts and claims. A gold medal was awarded for the representation by the jury."

In the *American Journal of Mining* (July 27, 1867), of which R. W. Raymond was editor, is the following editorial: "The collection of minerals sent from Colorado to the Paris Exposition has won, as it deserved, a gold medal. It was complete and splendidly arranged, accompanied with assays, maps, and descriptions, in English and French and German, of the resources of Colorado. The Coloradans are congratulating themselves on the result of their experiment, which, it is said, is already bearing fruit in the way of increased attention on the part of foreign capitalists to that portion of the United States. Mr. J. P. Whitney, the Commissioner from Colorado, receives much credit for his connection with the enterprise. We take the liberty of calling the attention of our friends in Colorado to Mr. George W. Maynard, late of Central City, as the individual to whom their thanks are chiefly due for the thorough arrangement of the collection which has won such favor abroad. The fact is, Colorado need not boast of public spirit in this connection. If we remember aright, Messrs. Maynard & Martine made all the assays of these minerals and arranged the entire collection. In return for this the citizens failed to respond to the movement inaugurated by the Governor, for sending Mr. Maynard as Commissioner. The Governor was finally obliged to substitute the name of Mr. Whitney, who went at his own expense, and deserves all the glory he has won, for his public spirit. Meanwhile Mr. Maynard, who had received no reward for the expenditure of considerable time and money, should at least share in the credit of the triumph, and we are persuaded Mr. Whitney would be the first to accord him that praise which is fully his due."

The suggestion of Mr. Raymond as to the recognition of the preliminary work in Colorado was not acted upon by Mr. Whitney, for there is no reference to it in his pamphlet. The gold medal was awarded to Mr. Whitney, instead of to the Territory, and has not been turned over to the Territory. I have frequently brought this matter to the attention of the Governor and other State officials, but have not been able to create any interest in the matter.

It is pleasant to note that several of my fellow students at Chausthal became my assistants in Central City, among them Hermann Stoelting, who lost his life in the wreck of the *Schiller* on the Scilly Isles. Wolters and Huepeden, who subsequently held important positions in Idaho and Montana, were also assistants of mine. Charles A. Martine, who began his career as assistant to Professor Joy, at Columbia, finally came to Central City and was my chief assistant for a year previous to my departure for New York. He succeeded to my business as assayer, and subsequently settled in Georgetown, where he became very successful in mining and in the development of new methods for the treatment of silver ores. He died greatly regretted by the entire community.

Central City, Idaho Springs, and Georgetown differed greatly in the character of their inhabitants, from the mining camps farther west. I recall but one case of shooting in Central during the three years of my residence. As a rule the miners and all the laboring men were a superior class, and to the prospectors is due the credit of having made discoveries which finally resulted in the development of some of the most important mines which have been worked to the present day. The majority of the mine superintendents, mill-owners, and merchants, were cultivated young men from Boston, Providence, and other Eastern cities, who came to Central with their wives, so that there was a really refined society. A circulating library was established, to which Harper & Bros., D. Appleton & Co., and other publishers contributed. George Bancroft, the historian, presented a complete edition of his works. Three or four religious bodies were well represented, so that there was a general observance of the Sabbath. Many of the 'old families' of the present day in Denver had their beginnings in Central City.

EMERALD MINES IN COLOMBIA.

Until 1830 all the emeralds in the market came from Colombia. Since that time 10% have come from the Ural Mountains and Norway. Some good-sized stones, though not free from flaws, have been found in Alexander county, North Carolina. No emerald mines are known in Mexico or Peru, and those that the Spanish conquistadores first brought from the latter place doubtless originated in Colombia. Later they discovered the real source. To this spot, known as Somondoco, in the department of Boyaca, lying about 125 m. from Bogotá, the Spaniards were brought by the Indians; and an account is extant of how Pedro Fernandez de Valenzuela made the journey, and extracted the stones from the calcite veins in which they commonly occur. At Muzo the jewels are still obtained from excavations in a dark bituminous limestone, which rests on clay shales containing ammonites, showing it to belong to the Lower Cretaceous. From Muzo also is obtained the rare amber colored fluocarbonate of cerium, called parisite from the name of its first discoverer. Its brittleness renders it of little value as a gem stone, but it is a prize to the mineralogist.

Tin is found in the Black Hills, but has only been produced in small amounts. The output from the United States is insignificant, forming less than one per cent of the world's output.

ALASKA BUILDING, A.-Y.-P. EXPOSITION.

Herewith is presented a view of the Alaska building at the Alaska-Yukon-Pacific Exposition, now opening at Seattle. The building has 36,000 sq. ft. of floor space, which is taken up by exhibits that admirably represent the resources, industries, scenery, and general features of Alaska. As wall-decorations there are panoramic views of the coast range, the glaciers, mining operations, and scenes on the Yukon. There are relief maps, geologic exhibits, mineral specimens, ores, gold bullion, and miniature operations that represent the mining industry of the Far North. The forestry of that country is represented by sections of trees; the fisheries and the fur interests are being well displayed, and when the season is further advanced there is to be an exhibit of flowers and flowering plants from the banks of the Yukon. Paintings by Alaskan talent and artistic work in woman's department will also be attractive features. Alaska has much to show, and the exhibit will command the attention and admiration of thousands of visitors to the Exposition who are unable to visit the country itself.



Alaska Building, A. Y. P. Exposition, Seattle.

A new zinc-lead concentrating plant, with a capacity of 1000 tons of ore per day, has been erected by the Humboldt company, Bleischarley mine, upper Silesia. The plant, which is operated electrically, comprises six sets of washers, averaging 170 to 180 tons each per day, the rich intermediate products from these being further treated in two small sets, and the low-grade intermediate products in two large sets of apparatus. The slime-washery is fitted with six washers, with two separate sets for treating the mixed slimes recovered from the waste water and settling tanks. The products are handled in narrow-gauge trucks, which are shunted by electric locomotives and hoisted to the tipples at the storage bins by electric lifts, similar lifts being installed at the waste heap. The consumption of power is about 1600 hp., distributed through 17 electric motors. The total cost of treating the ore, including labor, supervision, and keep, will be less than 30c. per ton of crude ore.—Oesterreichische Zeitschrift für Berg und Hüttenwesen.

GEOLOGIC NOTE ON LIBERTY BELL.

Written for the MINING AND SCIENTIFIC PRESS
By AN OCCASIONAL CONTRIBUTOR.

The Liberty Bell mine, at Telluride, Colorado, lies chiefly within the San Juan formation of indurated andesitic tuffs, but extends through into the underlying quartz-conglomerate, which is of doubtful Eocene age. The displacement of the walls at the contact is about 100 ft. where explored, the hanging-wall contact being the lower, as the fault is normal. There have been at least two important movements along the fault-plane, each followed by mineralization. The older vein-filling is quartz, which in places cemented the broken wall-rock into a hard tough breccia. This quartz is characterized in general by an equality of value between the gold and silver, taking the latter at 50c. per oz. After the quartz was deposited a second movement of the fault opened cavities, which were filled by calcite.

A third period of enrichment, of less importance than the other two, was one in which gold and a little wad were deposited in the joints and cracks of a broken zone at the juncture of the main vein with a branch vein in the hanging wall. No silica or calcite accompanies this enrichment, and large blocks of what looked like waste rock were shown by assay to be rich ore. There is in general an approximately horizontal distribution of values in the vein, resulting doubtless from the nearly horizontal bedding of the tuffs in which it lies. This condition is modified, of course, by the distribution of the ore-lenses, which do not lie horizontally, but pitch at various angles in different parts of the vein. It can readily be understood then that, with these conditions borne in mind, valuable hints could be obtained from a study of the map.

The asphaltite deposits in Eureka county, northeastern Nevada, about 15 miles south of Palisade, have been recently studied by Robert Anderson of the U. S. Geological Survey. This occurrence is interesting, for no asphaltite deposit has heretofore been found in Nevada. The asphaltite fills fractures in steeply dipping Carboniferous strata.

RAY COPPER DISTRICT, ARIZONA.

Written for the MINING AND SCIENTIFIC PRESS
By WILLIAM H. TRUESDELL.

The Ray district in Arizona is of great scientific and economic interest. Its prospect of importance as a copper-producing district makes the subject of the local geology pertinent. Ray is situated on Mineral creek, about five miles north of Kelvin, on the eastern border of Pinal county. It lies in an area which has not yet been mapped by the U. S. Geological Survey, being just outside the eastern limit of the Florence topographic sheet, and 5½ miles south of the southwestern corner of the Globe quadrangle. Dripping Spring range is the name locally applied to the mountain ridges in the area, but there seems to be no definite boundary between these and the Superstition range to the northwest. The valley of Mineral creek lies between two ridges having a northwesterly trend, the width at Ray being approximately four miles, and the altitude of the town about 2200 ft. The slopes of the western ridge rise to 4000 ft. at the northern end, the crest gradually falling away to the Gila river. The eastern ridge rises 300 to 400 ft. higher. Mineral creek has a bed of even grade to the Gila river at Kelvin. At Ray a group of irregular hills, distinguished by their reddish color from the surrounding country, forms the lower part of the slope of the western ridge. They rise to a height of 400 to 500 ft., and cover an area of about two square miles. A correct idea of the age and character of the formation composing these hills is important, as it is in them that the deposit of chalcocite is found.

The formations of the Globe quadrangle, which are represented in the Ray district, are given in the table below'* which will serve as a geological summary:

SEDIMENTARY ROCKS.

Quaternary.
- Alluvium.
- Gila conglomerate.

Tertiary.
- Whitetail formations.

Devonian-Carboniferous.
- Globe limestone.

Cambrian.
- Apache group. Dripping Spring quartzite.

Pre-Cambrian.
- Pinal formation (schist).

IGNEOUS ROCKS.

Quaternary.
- Basalt flow.

Tertiary.
- Dacite flow.

Mesozoic.
- Dikes of diabase and diorite-porphyry.

Pre-Cambrian.
- Dikes of quartz-porphyries.
- Granular and porphyritic types of granite and diorite.

The Pinal schist, as described in the Globe quadrangle, consists of metamorphosed silicious sediments of pre-Cambrian age. The formation in the hills at Ray is considered to represent the Pinal schist, but it has undergone less metamorphism, and bears a closer resemblance to the partly metamorphosed grits and sandstones described in the Globe area. In a straight line, it is only 7 miles to the nearest area of Pinal schist in the Globe quadrangle. At Ray, the formation passes from laminated quartzite, through quartz-schist to sericite-schist, according to the distance from the contact with the intrusive granitic rocks. The small dikes of quartz-porphyry had little effect in producing the schistosity. At the southeastern edge of the exposed beds, along the west side of the creek, some distance below the bridge, the sediments are least altered. At this locality a gray quartzite is found, with laminations about two millimetres thick, of small white quartz grains. Disseminated grains of copper sulphides give a greenish-gray tinge to the rock.

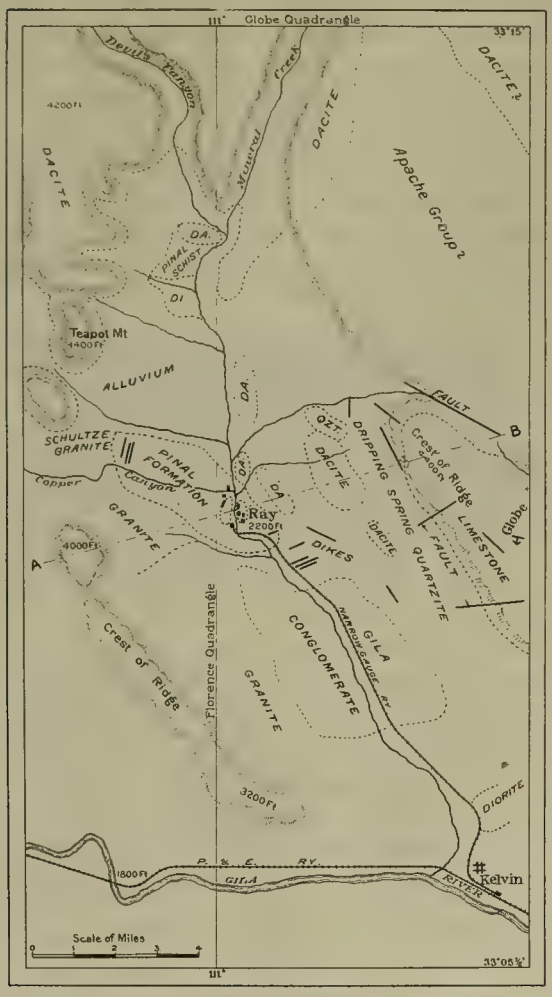
On the hill above the Ray shaft, the rock is more schistose and the color is pinkish-purple, from the presence of iron oxide. Another variety is that in which the structure is more massive, with curved laminations. In the northwestern part, as the contact is approached, where the sediments have been most crumpled and contorted, the rock approaches the character of a sericite-schist. It is a much-jointed gray rock, with platy laminations, having a finely crystalline appearance.

Study of thin sections shows the chief difference between these beds and the Pinal schist of the Globe quadrangle to be in an absence of re-crystallization of the original grains, and an absence of secondary accessory minerals. Mica has not been developed to aid in the production of schistose cleavage. Microscopically, the rock is seen to be composed of quartz grains in which no originally fragmental character is apparent. There is a tendency to parallelism shown in the arrangement of grains in layers of the same size, alternating with those of different sizes. While some of the larger grains appear to have been crushed, there is no flattening, nor is there any secondary enlargement of grains. For the most part, the only effect is that produced by incipient mechanical crushing, though it is possible that some areas not inspected may yield evidence of greater metamorphism. A mica-schist of true crystalline character, which is doubtless the Pinal schist, is exposed on the lower slopes of the eastern side of Teapot mountain, but its relation to the area under discussion is obscured by overlying gravel.

The intrusion of the granitic batholiths produced a notable effect in disturbing the position of the beds. Their induration was caused at the same time, so that erosion in bringing into relief the harder ledges aids in defining the limits of the different disturbed blocks. The irregular attitude of some of the hills, with thin steep scarps, suggests faulting. It would be difficult to estimate the amount, and would require a close study of the planes of schistosity and jointing. There are bands of greatly shattered breccia included in the formation. The period of brecciation, and whether movement occurred along these planes, have not been determined. In the northwestern part of

*Professional Paper No. 12, and Folio No. 111, U. S. Geological Survey.

the area, near the contact with the Schultze granite, are to be found the greatest effects of the intrusion. The crushing which the beds have undergone has crumpled and contorted them to a high degree. The direction of the schistosity varies in a small space. The district is not favorable for finding actual contacts with the granitic intrusives. The fact of intrusion is to be made out by the contorted condition of the schist, and the porphyritic facies of the granite near the contact. The same difficulty arises with respect to finding evidence of the unconformity between the Pinal formation and the Dripping Spring

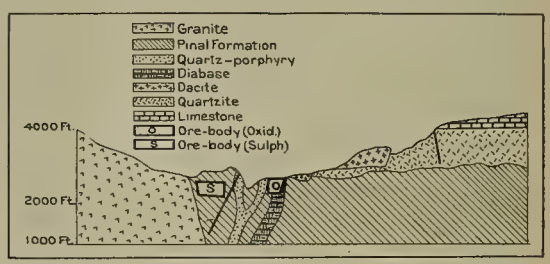


Map of Ray District.

quartzite on the eastern side of Mineral creek. As the Pinal formation crosses the creek into the lower part of the town, there is difficulty in distinguishing it from blocks of the latter formation brought down by faulting.

The Dripping Spring quartzite and the Globe limestone form the mass of the eastern ridge. The presence of the lower member of the Apache group, called the Pioneer shale, was not ascertained, but as 700 to 800 ft. of the assigned thickness of the group (800 to 1000 ft.) is exposed in the section on the ridge, a closer examination may prove its occurrence at the base of the quartzite beds. The upper member, or Dripping Spring quartzite, forms massive projecting ledges. Some of the beds are of fine-grained white quartzite, while others are composed of a coarser grit, cemented by hematite, giving a reddish color to the rock. The Globe limestone, a gray to black, compact rock, cherty in places, overlies the quartzite, and is apparently conformable. The upper part has been removed by erosion, but 250 ft. still remains. For a long distance down the slope, in the direction of Kelvin, it forms the summit of the ridge. The upper eroded surface is quite fossiliferous, containing brachiopods, cup-corals, and crinoid stems. A few imperfect specimens were identified as Carboniferous forms.

Excluding the hills of the Pinal formation, the western ridge is carved from several types of granitoid rocks. Commencing at the southern edge of the hills, composed of Pinal sediments, a gulch heading toward the conical peak south of Teapot mountain, and the Copper canyon road, appears to mark the boundary of the formation. On the south side of the gulch a black copper-stained, slaty quartzite extends southward until it is covered by the Gila conglomerate. A little to the west outcrops of granite are



Structure of Ray District Along Line A-B.

found. It is a fine-grained grayish rock, with green hornblende, which on weathered surfaces appears in the form of black spots. Apparently cutting this to the north is a medium-grained light-colored biotite-granite. This occurs about one-eighth mile west of the hill on which the Ray shaft is situated. At a point about a half mile north of Kelvin an exposure of granitic rocks is found for a distance of a quarter mile along the tramway. There are two types; one is reddish, has much biotite and large pink feldspars, and is silicified in places. The other is a holocrystalline grayish-white rock, with a grain of 2 to 5 mm. diam. Its components are abundant feldspars, what appears to be fibrous green hornblende, and a small amount of clear quartz in rounded grains up to one centimetre in diameter. Microscopically, there is more groundmass than would be expected. The feldspar is much altered, but a large proportion is evidently plagioclase. No original hornblende appears, the areas being now filled with chlorite and magnetite. The rock is probably a diorite, and resembles some types of the Madera diorite. At the eastern base of Teapot mountain a granitoid rock is exposed which is also doubtfully classed with the Madera diorite, the proportion of plagioclase being hard to estimate, due to alteration. It is a speckled greenish-black and white rock, with a grain of 2 to 3 mm., composed of white plagioclase, greenish-black hornblende, small amount of biotite, and still less quartz. There remains to be considered a mass of granite-

porphyry on the northwestern edge of the Pinal formation, bearing evidence of an intrusive character. The porphyritic facies occurring near the contact resembles closely the similar facies of the Schultze biotite-granite in the Globe area, with the exception of the smaller amount of biotite in the former. The noteworthy characteristics of the granite-porphyry at Ray are the large phenocrysts of perfect orthoclase crystals, and the quartz phenocrysts. The former are flesh-colored and reach a length of 6 cm. Many are twinned after the Carlsbad law. The quartz tends to crystallize in bi-pyramidal forms up to 1 cm. long. The ground-mass contains numerous small crystals of pink orthoclase in a finer greenish-white paste. Hornblende occurs sparingly. A thin section shows the typical fabric of a quartz-porphyry, which, as remarked in the Globe folio, would not be expected in a rock of this crystalline character.

Pre-Cambrian dikes and intrusive masses in the Pinal formation are not very prominent, because of their similarity in color to, and lack of contrast in hardness with, the Pinal sediments. In the northwestern area a few dikes of quartz-porphyry occur. They have a pink felsitic ground-mass, with small white opaque feldspars. Quartz phenocrysts occur sparingly, rounded by corrosion and averaging 3 to 7 mm. in length. In one dike phenocrysts are absent. Thin sections show the feldspar greatly altered, and exhibit the ordinary type of quartz-porphyry. On the hill above the Ray compressor-house a larger irregular mass of the same type is exposed. In the thicker parts it carries some biotite, and the texture approaches that of a granite-porphyry. One or two dikes radiate from this mass. On the eastern side of the creek, at the base of the slope just north of the Arizona Hercules buildings, is an outcrop of fresh biotite granite-porphyry, intrusive in hard quartzite, having a vertical irregular schistosity. The dikes and irregular masses are probably connected with the Schultze granite-porphyry.

Diabase and diorite-porphyry dikes, of post-Carboniferous age, are more prominent and numerous on the eastern ridge, where they cut both the Dripping Spring quartzite and the Globe limestone. One diabase dike cuts the quartz-porphyry mass on the Ray hill, the only one noted on the surface west of Mineral creek. There is also a body of diabase near the granite-porphyry across the creek, but the relation between the two is obscure. Within a mile below the bridge, at Ray, along the tramway, four diabase dikes are met. About a half mile lower occurs another dike several hundred feet thick. It is a tough finely crystalline, grayish-black rock, composed about equally of ferro-magnesian minerals and small feldspars. A thin section shows an intersertal texture, with no original pyroxene. This is altered to aggregates of hornblende and chlorite. The plagioclase is fairly fresh, while magnetite and some secondary quartz are sparingly present. Other dikes show coarser textures, and in some the intersertal texture is apparent megascopically. In the same distance two dikes of a different type occur. They are much altered, and have white opaque feldspars in a greenish-yellow ground-mass, similar to those described as diorite-porphyry in the Globe quadrangle.

The dacite flow and the Whitetail formation next demand attention. The flow of biotite-dacite, with the glassy variety of its base, is petrographically the most interesting rock in the district. The southern termination of the flow in this locality forms the capping of Teapot mountain, which appears as an isolated mass from the south, 2½ miles northwest of Ray. To the north it covers a wide area. To the west of Devil's canyon branch of Mineral creek it is a much dissected area. On the eastern side of this branch the flow does not extend so far south. Four miles up the creek the rock forms both walls of the narrow canyon. The thickness of the flow on Teapot mountain is about 300 ft., which increases to the north. The lower glassy portion, which is here persistent, is 15 to 20 ft. thick. That the flow once extended farther south is shown by the remnants on the eastern side of Mineral creek. The most southerly one noted is halfway up the ridge, as far as the conglomerate pinnacle, one mile below Ray. Petrographically, the rock is uniform over a wide area, and is similar in all respects to that described farther north. It is a fresh, fine-grained, porphyritic rock, of pinkish-gray color, carrying fragments of other rocks. Abundant feldspars, fewer plates of biotite, and infrequent hornblende prisms are the noticeable phenocrysts. The average size is 1 to 3 mm., the latter size being rare. Quartz is insignificant as determined megascopically. Under the microscope the feldspar is seen to be plagioclase and the ground-mass glassy.

The lower part of the flow is largely a black glass of resinous lustre, with abundant clear glassy feldspars 1 mm. in length, a few reaching 7 mm. These are less fresh, and form a typical vitrophyric texture. The rock presents fine examples of wavy flowage-lines in the glass ground-mass. Underlying the remnants of the flow is a tuff resembling a felsitic rhyolite, having compact pink bands streaked with seams of white pumice. A thin section shows it to be composed of angular glassy fragments, with quartz and plagioclase in a ground-mass of glass. Below the dacite capping of Teapot mountain the lower part of the slopes consist of at least 300 ft. of stratified gravel and sand belonging to the Whitetail formation. It is also seen at the base of the dacite along Devil's canyon.

The Gila conglomerate is most prominent as a valley-deposit between Ray and Kelvin, along Mineral creek, but remnants occur on the eastern ridge above Ray. Commencing with a sharp pinnacle one mile below Ray, beds of this formation extend on both sides of Mineral creek as far as two miles above Kelvin. On the western side, 2½ miles north of Kelvin, a steep cliff exposes a thickness of 200 ft. of horizontal sand and interbedded gravel from all the older formations. Some black basaltic knobs on the Florence plain are probably contemporaneous with the flow in the Globe quadrangle. In the vicinity of Ray none was observed.

The structure of the district is revealed by the examination of the greatly eroded area of stratified rocks on the west side of the granitic ridge at Ray. This ridge, with the schistose rocks of the Pinal for-

mation on its lower eastern side, has the aspect of a central nucleus, with sedimentary rocks resting unconformably on the eastern and western flanks. The eastern ridge from Ray south consists of a block of stratified rocks having a dip to the south. As seen from the summit of the ridge, this dip would carry it into the granitic area of the western ridge above Kelvin if it were not cut off by faulting. About 2½ miles north of Kelvin the dip changes to the east, and the trend of the ridge is up the Gila river, away from the granite. Opposite Ray the block terminates in rather steep cliffs marking a fault-line. The block is probably repeated in another to the north. From the slopes of the western ridge, a quarter mile below Ray, looking east to the opposite ridge, a fault can be noticed breaking the monoclinal dip of the Globe limestone beds on the summit, and another can be seen one mile south, with a fold in addition. The mass of the dacite flow extending from Teapot mountain four miles north to where it forms Devil's canyon is evidently faulted down to the north, as in this distance the base is cut by the creek, while at Teapot mountain it is at least 1500 ft. above it. Minor faulting, probably of different periods, as in the



Mineral Creek at Ray With Arizona Hercules Workings and the Eastern Ridge in Background.

Globe quadrangle, has taken place on the eastern ridge, resulting in dropping blocks of the Dripping Spring quartzite. One such fault can be seen along the tramway, three-fourths of a mile below Ray. Small masses of dacite are involved in the same movement, so that they have been dropped hundreds of feet below the capping of Teapot mountain, though part may be due to irregularities of the ground covered by the flow.

A few notes on the copper ores are appended, notwithstanding their incomplete character. In economic importance and geologic relations the deposits may be grouped into two classes. The first consists of bodies of oxidized ores closely related to the diabase dikes. It furnishes the noticeable surface indications of the presence of copper throughout the district. The first exploration work was done on these. There are three orebodies of important size which can be examined in open-cuts. The largest is that in the diabase dike at the Ray mine; the second is exposed on the Arizona Hercules property, and another, also in diabase, may be seen about a mile to the northeast. The ore in all of them occurs in irregular masses, with many narrow seams. In the mass at the Ray mine the ore-minerals are malachite, probably oxides, a little chalcocite, and small particles of metallic copper. The diabase of the Arizona Hercules orebody is perhaps better described as an irregular mass than a dike. The ore from this working appears to be mostly green to black chrysocolla, in kernel-like structure, forming brittle masses. The black layers may be melaconite, or they may owe their color to manganese dioxide. In the third locality mentioned, the carbonate ore has a higher tenor than elsewhere. A trace of azurite is found here in thin seams in the malachite. The latter has been deposited as a cement in small remnants of the Gila conglomerate in some of the side gulches, being transported by the surface-waters, and it also stains patches of the brecciated quartzite along the creek. Cuprite was noticed in small masses in the Dripping Spring quartzite in the gulch at the north end of the area.

Of greater future importance is the deposit of low-grade sulphide, requiring concentration, which occurs at a comparatively shallow depth in the schistose rocks of the Pinal formation. The greatest underground development of this ore is at the Ray mine, where the shaft is 350 ft. deep. Mineralogically, the ore is simple, consisting of iron pyrite, possibly some chalcopyrite, and chalcocite disseminated in small particles through the rock, while pieces may be obtained showing veins of massive chalcocite one-half inch thick. That the chalcocite is of secondary origin is shown by the films of this mineral covering grains of pyrite, so that the percentage of copper is less than would be supposed on first inspection.

The exploration with churn-drills being carried on by the Ray Consolidated Copper Co. shows that there is a zone of oxidation above the main sulphide orebody in which carbonates and metallic copper occur, accompanied by much hematite. The copper is of secondary origin similar to that in the oxidized orebodies previously described. The limits of the orebody are generally found between the depths of 200 and 450 ft., and water is usually present at this depth. In some localities the last drillings contained pyrite only, indicating the lower limit of the zone of secondary sulphides. The relation of the surface of the orebody and the water-level to the overlying topography is an important subject yet to be worked out.

While the chalcocite is of secondary origin, a detailed study is required to determine the original source of the copper solutions and the wide dissemination of the primary sulphide. Masses of diabase and granitic rocks, with porphyritic variations, are liable to be found in any part of the area of Pinal schistose quartzite below the surface. Of these, the diabase intrusions, which are later in date than the others, are the most likely source of the copper, and the two types of deposit may have a common origin.

A bulletin has just been issued by the U. S. Geological Survey which discusses most of Esmeralda and Nye counties, Nevada, and Inyo county, California. It describes not only the region about Goldfield, but also Pahute mesa and the ranges near it, the Amargosa desert and mountain system, Death Valley, and the Panamint range. Besides gold, it discusses the water, vegetation, culture, and animal life of the region. It is accompanied by a geologic and topographic map. It is published for free distribution.

IRON ORE SUPPLY OF THE UNITED STATES.

By C. Willard Hayes.

*A chemical and geological classification of iron ores places the commercial deposits in six classes: (1) magmatic segregations in basic igneous rocks; (2) contact deposits formed in connection with igneous intrusions; (3) concentration deposits; (4) replacement deposits; (5) bedded deposits; and (6) gossan deposits. The iron ores are further distinguished under two classes: available and not available. This classification is in large measure arbitrary, and it is evident that it will vary from time to time. Actual production, past and present, being determined by the interaction of various factors, affords the best criterion of availability. For convenience, the known ore deposits are taken up by groups, based on distribution and kind. These groups are the following: 1. Lake Superior ores. 2. Adirondack ores. 3. Clinton ores. 4. Appalachian metamorphic ores. 5. Appalachian brown ores. 6. Appalachian carbonate ores. 7. West Tennessee brown ores. 8. East Texas brown ores. 9. Ozark ores. 10. Rocky Mountain metamorphic ores. 11. Igneous contact ores.

1. Lake Superior Ores.—The estimates of the Lake Superior ores are based upon the confidential records of practically all the mining companies of the region. The available ore under present conditions is taken to include all ore above 55% iron, and 25% of all ore between 45 and 55% iron. A recent compilation of diamond-drill samples indicates that the average content of iron in the iron formation, excluding the beds now considered ore, exceeds 37% of metallic iron. This may be regarded as constituting a low-grade ore not now available.

2. Adirondack Ores.—Estimates of the Adirondack ores are based upon information furnished by the New York State Survey. A certain portion of the titaniferous magnetites are included. This is on the assumption that either the percentage of titanium will be reduced by concentration methods, or the ores will be made available by modifications in furnace practice and the use of a special flux.

3. Clinton Ores.—The estimates of the New York Clinton ores are based upon information furnished by the New York Survey, and those in the Southern States chiefly upon information obtained by the United States Survey. Calcareous Clinton ores, carrying 30% metallic iron, are classed as available, provided they are so situated as to be economically mined. None of the silicious Clinton ores are considered at present available.

4. Appalachian Metamorphic Ores.—These ores include the deposits of magnetite and specular hematite, associated with crystalline and metamorphic rocks, of the Piedmont and Appalachian mountain belts, from southern New York to Alabama. Much uncertainty exists regarding the available tonnage in these deposits, and the estimates are correspondingly of low value.

5. Appalachian Brown Ores.—This division in-

*Abstract of report prepared for the Conservation Commission and published in the Trans. Amer. Inst. Min. Eng.

TABLE I—ESTIMATES OF IRON-ORE SUPPLIES OF THE UNITED STATES, IN LONG TONS.

Commercial districts.	Magnetite ores.				Hematite ores.				Brown ores.		Carbonate ores.		Total supplies.	
	Non-titaniferous.		Titaniferous.		Specular and red.		Clinton.						A.	B.
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	Available.	Not available.
1. Northeastern	160,000,000	111,500,000	90,000,000	100,000,000	2,000,000	2,000,000	35,000,000	620,000,000	11,000,000	13,500,000	.....	248,000,000	298,000,000	1,095,000,000
2. Southeastern	[1]12,500,000	23,000,000	.....	.....	8,000,000	53,000,000	463,540,000	970,500,000	54,400,000	168,000,000	.....	62,000,000	538,440,000	1,276,500,000
3. Lake Superior	4,500,000,000	.....	25,000,000	3,500,000,000	67,475,000,000	10,000,000	30,000,000	.....	.....	.....	.....	.....	3,510,000,000	72,030,000,000
4. Mississippi Valley	.....	.....	.....	15,000,000	10,000,000	.....	.....	.....	300,000,000	560,000,000	.....	.....	315,000,000	570,000,000
5. Rocky Mountain	[1]51,485,000	[2]115,440,000	.....	1,500,000	4,275,000	2,100,000	.....	.....	2,000,000	1,625,000	.....	.....	57,760,000	120,665,000
6. Pacific Slope	[1]68,950,000	11,800,000	.....	2,000,000	.....	10,000,000	.....	.....	.....	105,000	.....	.....	68,950,000	23,905,000
Totals	232,935,000	4,761,740,000	90,000,000	128,500,000	3,529,275,000	67,552,100,000	508,540,000	1,620,500,000	367,400,000	743,230,000	.....	310,000,000	4,788,150,000	75,116,070,000

1. Vermont, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Ohio. 2. Virginia, West Virginia, East Kentucky, North Carolina, South Carolina, Georgia, Alabama, East Tennessee. 3. Michigan, Minnesota, Wisconsin. 4. Northwest Alabama, West Tennessee, West Kentucky, Iowa, Missouri, Askansas, East Texas. 5. Montana, Idaho, Wyoming, Colorado, Utah, Nevada, New Mexico, West Texas, Arizona. 6. Washington, Oregon, California.

[1]Includes some hematite.

[2]Includes some titaniferous magnetite.

cludes those deposits of limonite and other hydrous oxides which occur associated with the closely folded belt of sedimentary rocks from Pennsylvania southward to Alabama. Of these, the Oriskany ores are most readily estimated, while the ordinary concentration deposits of brown ores associated with other formations cannot be estimated with any degree of accuracy. The estimates of competent experts differ from the figures given in this paper by factors varying from 0.7 to 3.

6. Appalachian Carbonate Ores.—This division includes the thin beds of ore associated with the Carboniferous rocks of western Pennsylvania, eastern Ohio, and Kentucky, formerly an important source of iron, but now practically unworked. All of these ores are placed in the not-available class.

7. West Tennessee Brown Ores; 8. East Texas Brown Ores; and 9. Ozark Ores.—From the nature of distribution and occurrence, estimates of the tonnage of ores in these districts in the lower Mississippi Valley are very uncertain.

10. Rocky Mountain Metamorphic Ores.—This group embraces deposits of magnetite and specular hematite associated with crystalline schists and gneisses at various localities in the Rocky Mountain region. Except the deposits in the Hartville district, Wyoming, very little is known concerning their distribution or tonnage.

11. Igneous Contact Ores.—This group is based exclusively upon geologic relations, and includes widely separated deposits, the principal ones in the East being the Cornwall type of eastern Pennsylvania. Most of them are situated in the Rocky Mountain and Pacific States. Some of these deposits are fairly well known, but concerning others only the roughest sort of an estimate is available.

I have considered very briefly the supplies of foreign iron ores so situated that they will probably enter into the iron industry of the United States in the future (see Table II). These are the Canadian and Newfoundland ores and Cuban ores. None of these countries has an abundant fuel supply, and therefore either the fuel must be imported or the ore exported. The history of the iron industry indicates that the latter is more likely to occur, particularly since the industry is already established, and the chief market for the finished product is near the fuel supply.

TABLE II—ESTIMATED AVAILABLE FOREIGN IRON ORE, IN LONG TONS.

Canada:	
British Columbia, magnetite chiefly	30,000,000
Lake Superior district, hematite chiefly	9,000,000
Nova Scotia, Clinton hematite	4,000,000
Newfoundland, Clinton hematite	30,000,000
Mexico, magnetite and brown ore	.....
Cuba:	
Santiago district, hematite	5,000,000
Mayari, Moa, Baracoa, Cubitas, and Pinar del Rio districts (limonite)	1,500,000,000
	1,578,000,000

Imports and exports of iron ore, in long tons.

Total imports, 1889-1907	14,705,842
Total exports, 1889-1907	1,271,214

The production of iron ores by commercial districts in 1906 and 1907 is given in Table III.

TABLE III—PRODUCTION OF IRON ORES IN THE UNITED STATES IN 1906 AND 1907.

District.	1906. Long tons.	1906. Total. %	1907. Long tons.	1907. Total. %
Northeastern	2,582,666	5.40	2,822,822	5.45
Southeastern	6,208,140	13.00	6,197,360	12.00
Lake Superior	38,035,084	79.66	41,638,744	80.50
Mississippi Valley	117,570	0.25	230,435	0.46
Rocky Mountain*	806,268	1.70	831,258	1.60
Total	47,749,728	100.00	51,720,619	100.00

*The small production of California and Washington is included in the production of the Rocky Mountain district.

The data in Table III indicate the commanding position of the Lake Superior district in the iron industry, with 79.66 and 80.50% of the total production for the years 1906 and 1907.

The production of iron ore in the United States by decades, from 1870 to 1909, is given in Table IV.

TABLE IV—PRODUCTION OF IRON ORE IN THE UNITED STATES BY DECADES, 1870 TO 1909.

Decade.	Production, long tons.	Increase, %.
1870-1879	43,770,527	....
1880-1889	91,043,854	108.0
1890-1899	163,989,193	80.1
1900-1909	about 392,000,000	138.0

Each of the decades given in Table IV, if shown by a production-curve, would contain a depression in which there was an actual decrease in production, so that they may be taken as fairly representing the tendency of the industry. These rates of increase are such that they do not permit the construction of a curve on which predictions for the future can be based. A comparison of the first and second rates, 108 and 80.1, would indicate a rapid decrease in the rate of increase, which if continued would have placed the date of maximum production at about 1930. But a comparison of the second and third rates, 80.1 and 138, would indicate a rapid increase in the rate of increase. If the average rate of increase by decades, 108%, should be continued, it would require the production in the next three decades of 6,088,000,000 tons. But the ore supply now available in the United States is estimated at 4,786,000,000 tons, which is only 78% of the amount needed on this assumption. It is evident, therefore, that the present average rate of increase in production of high-grade ores cannot continue even for the next 30 years, and that before 1940 the production must have already reached a maximum and begun to decline, and a very large use must be made of low-grade ores not now classed as available. The second condition, with its consequent greatly increased cost of iron, is the only thing which can prevent a decline in the iron industry, measured by the amount of pig-iron produced, within the next 30 years, unless there is in the meantime very greatly increased importation of foreign ores.

In view of the many factors entering into the problem, the tendency of which is not always determinable, to say nothing of the weight that should be given them, any further prediction as to the date of exhaustion of the iron-ore supplies is so uncertain as to be wholly unprofitable and unwarranted.

COMPANY REPORTS.

WAIHI GOLD MINING CO., LTD.

The report for 1908 on the famous New Zealand gold mine shows that during the year 393,214 tons of ore were treated. The gold and silver realized amounted to £930,511 7s. 6d., which, with £9023 2s. 5d. from interest, gave a total revenue of £939,534 9s. 11d. The profit for the year was £558,141 10s. 9d., which was an increase of £27,230 17s. 7d. over that for 1907. Regular dividends for the year amounted to £371,930 5s. This, with the bonus of £49,500 14s. recommended, this is equivalent to 17s. per share for the year. The ore reserves on December 31 were estimated at 1,329,872 short tons, as compared with 1,299,979 at the corresponding period the year before. Development during the year was satisfactory. In order to provide power for a larger pumping plant, two 750-hp. Crossley gas-producers and two 368-hp. gas-engines, with two electrically driven three-throw ram pumps, have been ordered. A new steel head-frame has been erected at shaft No. 4. The total number of stamps running was 315 out of 330. The average stamp duty was 4.17, a slight increase. The extraction at the Waihi mill, according to assay, was 89.3% of the gold and 75.8% of the silver. At the Victoria mill the corresponding figures were 91.2 and 72.3, and at the Union mill, 88.4 and 69.5. The concentrate was treated at the Victoria mill with a saving of 96.28% of the gold and 92.95 of the silver. At the acid treatment plant 1,591,674 oz. of doré, valued at £898,775 15s. 1d., were treated.

STANDARD CONSOLIDATED.

This company, whose mines near Bodie, California, have produced bullion to a total value of $15,406,176, paid in 1908 a dividend of $35,678, making a total of $4,294,130 since the consolidation in 1879. Adding to this the $900,000 prior dividends, a total of $5,194,130 in profits stands to the credit of the property. Recently the company had not done well, and a new management was installed for 1908. Within the year substantial progress was made in reorganizing the business of the company and putting both mine and mill in shape. W. H. Landers, superintendent, presents a report replete with detail. The ore reserves are stated to amount to 4380 tons. Within the year 3282 ft. of development were driven, at a total expense of $18,687. This produced 2047 tons. The high cost is explained by the price of labor and the small size of the veins, which vary in width from 1 to 4 in., and show little cleavage between vein and wall. Owing to a strike, active operations were confined to 10 months. In that time 14,229 tons were extracted and milled, a duty of 2.8 tons per stamp per day. The average value of the ore per ton was $16.36; of the tailing which goes to the slime plant, $6.08; and of the tailing from the latter, $1.13. The total indicated extraction was 90%, and the actual 87.92. An interesting feature of the report is a table showing the actual amount of work done on each vein, its cost for labor, and the amount of ore developed. The extremely variable cost of ore is well shown.

ESPERANZA, LTD.

The Esperanza, Ltd., is an English company owning 449,800 out of a total of 450,000 shares of the Esperanza Mining Co., operating mines at El Oro, Mexico. In 1908 dividends to the amount of £307,136 3s. 5d. were paid, and at the end of the year the liquid assets were £172,997. According to Cortlandt E. Palmer, consulting engineer, the total production of this property has amounted to ₱49,114,860. In 1908, 145,451 metric tons, having a value of $2,146,290, were produced, at a profit of $927,616. Development amounting to 9513 ft. was accomplished, and was satisfactory on both the San Rafael vein and in the sulphide veins in the north end of the property. The ore reserves are estimated at 238,034 dry metric tons, capable of yielding a net profit of $2,177,222. The gross value per ton of output in 1908 was $14.75, as compared with $20.63 in 1907. Operating expenses were reduced 17% within the year, and amounted to $7.25 per ton, of which amount $5.87 was the cost of mining and milling, $0.54 selling, and $0.84 general administration. The report is accompanied by detailed maps and plans of the property.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

CONSTRUCTION OF EXPLORATION CONTRACT.

A contract by a land-owner with a prospector, giving him the exclusive right to explore certain lands for mineral substances, and by which the explorer agreed, in case of success, to pay the owner $100 per acre for the land within 90 days after any valuable discovery, the explorer was not bound to drill to find commercial substances or minerals, but was only required to purchase the land at the specified price in case of such discovery of commercial substances. And the finding of oil in less than paying quantities, and the finding of a stratum of salt several hundred feet below the surface, was not a success in finding commercial substances, within the meaning of the contract.

Anse La Butte Oil & Mineral Co. *v.* Babb, (La.) 47 South. 754. Dec. '08.

CONSTRUCTION OF COAL LEASE.

A coal lease provided that the lessee should pay a certain price for all coal that would pass over a screen of an eighth of an inch mesh, and that all that passed through should be classed as culm, and in case of sale of such culm, the lessee should pay one-tenth of the net profit to the lessor. In an action to recover the lessor's part of the profit on the culm, it was decided to be a question for the jury whether the entire cost for mining coal and culm was to be considered, or whether it was impossible for the lessee to prepare the royalty coal for market without producing culm, and that when sold the entire price, less the cost of loading such culm, was the net profit.

Woodruff *v.* Gundon, (Pa.) 71 Atl. 849. Jan. '09.

MINING CONTRACT—NATURE AND CONSTRUCTION.

A contract in consideration of one dollar and of a royalty, granted to the obligee all the bituminous rock and other minerals he might choose to mine, quarry, and take from certain lands; it further provided that in case the lands failed to produce minerals in paying quantities or of good quality, the obligee might, upon 30 days' notice in writing to the obligor, relinquish his rights, and that the obligee should pay royalty on 300 tons annually, whether taken or not. In the performance of the contract the obligee quarried and took away 27 tons of rock, and conducted no further operations to the time of his death, 15 years later, though he paid royalty for two years. In an action between the obligor and the heirs of the obligee, it was decided that the contract was not a grant of land nor a lease, but was a grant of a right only, and that all the rights of the obligee, and consequently of his heirs, were extinguished by the voluntary abandonment of the right, and that the obligor waived the 30 days' written notice required.

Payne *v.* Neuval, (Cal.) 99 Pac. 476. Jan. '09.

CONSTRUCTION OF OIL LEASE.

Land owners granted to a lessee the exclusive right to enter on certain lands, to drill wells, mine, and to do all that was necessary and proper for the development and extraction of oil, etc., with the privilege of passing over such lands and of maintaining necessary structures thereon for the objects of the lease; to hold the premises for 20 years, unless otherwise terminated, the lessee to have the right to abandon the lease at any time that it was deemed unprofitable to operate; the lessee to pay a stipulated royalty for all oil produced. Such a lease was held to vest no present title in the lessee to stratum of the land in place, but left the title to the oil in the land owner until it was brought to the surface, vesting in such lessee an estate for years for the purpose of taking oil therefrom, giving the lessee the right to extract and remove the oil from the premises, and which constituted for the time a servitude on the land.

Graciosa Oil Co. *v.* Santa Barbara County, (Cal.) 99 Pac. 483. Jan. '09.

Permissible Explosives.

*As a part of the investigation of mine explosions authorized by Congress in May 1908, it was decided by the Secretary of the Interior that a careful examination should be made of the various explosives used in mining operations, with a view to determining the extent to which the use of such explosives might be responsible for the occurrence of these disasters. The preliminary investigation showed the necessity of subjecting to rigid tests all explosives intended for use in mines where either gas or dry inflammable dust is present in quantity or under conditions which are indicative of danger. With this in view, a letter was sent by the Director of the United States Geological Survey on January 9, 1909, to the manufacturers of explosives in the United States, setting forth the conditions under which these explosives would be examined, and the nature of the tests to which they would be subjected.

Inasmuch as the conditions and tests described in this letter were subsequently followed in testing the explosives given in the list below, they are here reproduced, as follows: (1) The manufacturer is to furnish 100 lb. of each explosive which he desires to have tested; he is to be responsible for the care, handling, and delivery of this material at the testing station on the United States Arsenal grounds, Fortieth and Butler streets, Pittsburg, Pa., at the time the explosive is to be tested; and he is to have a representative present during the tests, who will be responsible for the handling of the packages containing the explosives until they are opened for testing. (2) No one is to be present at or to participate in these tests except the necessary Government officers at the testing station, their assistants, and the representative of the manufacturer of the explosives to be tested. (3) The tests will be made in the order of the receipt of the applications for them, provided the necessary quantity of the explosive is delivered at the plant by the time assigned, of which due notice will be given by the Geological Survey. (4) Preference will be given to the testing of explosives that are now being manufactured and that are in that sense already on the market. No test will be made of any new explosive which is not now being manufactured and marketed, until all explosives now on the market that may be offered for testing have been tested. (5) A list of the explosives which pass certain requirements satisfactorily will be furnished to the State mine inspectors, and will be made public in such further manner as may be considered desirable.

The tests will be made by the engineers of the United States Explosives Testing Station at Pittsburg, Pa., in gas and dust gallery No. 1. The charge of explosive to be fired in tests 1, 2, and 3 shall be equal in disruptive power to one-half pound (227 grams) of 40% nitroglycerine dynamite in its original wrapper, of the following formula:

	%
Nitroglycerine	40
Nitrate of sodium	44
Wood pulp	15
Calcium carbonate	1
	100

Each charge shall be fired with an electric fuse of sufficient power to completely detonate or explode the charge, as recommended by the manufacturer. The explosive must be in such condition that the chemical and physical tests do not show any unfavorable results. The explosives in which the charge used is less than 100 grams (0.22 lb.) will be weighed in tinfoil without the original wrapper.

The dust used in tests 2, 3, and 4 will be of the same degree of fineness and taken from one mine.[1]

Test 1.—Ten shots with the charge as described above, in its original wrapper, shall be fired, each with 1 lb. of clay tamping, at a gallery temperature of 77°F., into a mixture of gas and air containing 8% of methane and ethane. An explosive will pass this test if all ten shots fail to ignite the mixture.

Test 2.—Ten shots with charge as previously noted, in its original wrapper, shall be fired, each with 1 lb. of clay tamping at a gallery temperature of 77°F., into a mixture of gas and air containing 4% of methane and ethane and 20 lb. of bituminous coal dust, 18 lb. of which is to be placed on shelves laterally arranged along the first 20 ft. of the gallery, and 2 lb. to be placed near the inlet of the mixing system in such a manner that all or part of it will be suspended in the first division of the gallery. An explosive will pass this test if all ten shots fail to ignite the mixture.

Test 3.—Ten shots with charge as previously noted, in its original wrapper, shall be fired, each with 1 lb. of clay tamping at a gallery temperature of 77°F., into 40 lb. of bituminous coal dust, 20 lb. of which is to be distributed uniformly on a horse placed in front of the cannon and 20 lb. placed on side shelves in sections 4, 5, and 6. An explosive will pass this test if all ten shots fail to ignite the mixture.

Test 4.—A limit charge will be determined within 25 grams by firing charges in their original wrappers, untamped, at a gallery temperature of 77°F., into a mixture of gas and air containing 4% of methane and ethane and 20 lb. of bituminous coal dust, to be arranged in the same manner as in test 2. This limit charge is to be repeated five times under the same conditions before being established.

Note.—At least 2 lb. of clay tamping will be used with slow-burning explosives.

In response to the above communication applications were received from 12 manufacturers for the testing of 29 explosives. Of these explosives, the 17 given in the following list have passed all the test requirements set forth, and will be termed permissible explosives:

Brand.	Manufacturer.
Aetna coal powder A..	Aetna Powder Co., Chicago, Ill.
Aetna coal powder B..	Do.
Carbonite No. 1.....	E. I. Du Pont de Nemours Powder Co.,
Carbonite No. 2.....	Do. Wilmington, Del.
Carbonite No. 3.....	Do.
Carbonite No. 1 L. F..	Do.
Carbonite No. 2 L. F..	Do.
Coal special No. 1....	Keystone Powder Co., Emporium, Pa.
Coal special No. 2....	Do.
Coalite No. 1.....	Potts Powder Co., New York City.
Coalite No. 2D.....	Do.
Collier dynamite No. 2.	Sinnamahoning Powder Co.,
Collier dynamite No. 4.	Do. Emporium, Pa.
Collier dynamite No. 5.	Do.
Masurite M. L. F.....	Masurite Explosives Co., Sharon, Pa.
Meteor dynamite	E. I. Du Pont de Nemours Powder Co.,
Monobel	Do. Wilmington, Del.

Subject to the conditions named below, a permissible explosive is defined as an explosive which has passed gas and dust gallery tests No. 1, 2, and 3 as described above, and of which in test No. 4 1½ lb. (680 grams) of the explosive has been fired into the mixture there described without causing an ignition. Provided: (1) That the explosive is in all respects similar to the sample submitted by the manufacturer for test. (2) That double-strength detonators are used of not less strength than 1 gram charge consisting by weight of 90 parts of mercury fulminate and 10 parts of potassium chlorate (or its equivalent), except for the explosive 'Masurite M. L. F.', for which the detonator shall be of not less strength than 1½ grams charge. (3) That the explosive, if in a frozen condition, shall be thoroughly thawed in a safe and suitable manner before use. (4) That the amount used in practice does not exceed 1½ lb. (680 grams) properly tamped.

It may be wise to point out in this connection certain differences between the permissible explosives as a class and the black powders now so generally used in coal mining, as follows: (a) With equal quantities of each, the flame of the black powder is more than 3 times as long and has a duration 3000 to more than 4000 times that of one of the permissible explosives; also the rate of explosion is slower. (b) The permissible explosives are 1¼ to 1¾ times as strong, and are said, if properly used, to do twice the work of black powder in bringing down coal; hence only half the quantity need be used. (c) With 1 lb. of a permissible ex-

*Explosives Circular No. 1, U. S. Geological Survey.

[1]With a view to obtaining a dust of uniform purity and inflammability.

plosive or 2 lb. of black powder, the quantity of noxious gases given off from a shot averages approximately the same, the quantity from the black powder being less than from some of the permissible explosives and slightly greater than from others. The time elapsing after firing before the miner returns to the working face or fires another shot should not be less for permissible explosives than for black powder.

The use of permissible explosives should be considered as supplemental to and not as a substitute for other safety precautions in mines where gas or imflammable coal dust is present under conditions indicative of danger. As stated above, they should be used with strong detonators; and the charge used in practice should not exceed 1½, and in many cases need not exceed 1 lb. Inasmuch as no explosive manufactured for use in mining is flameless, and as no such explosive is entirely safe under all the variable mining conditions, the use of the terms 'flameless' and 'safety' as applied to explosives is likely to be misunderstood, may endanger human life, and should be discouraged.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

THE COPPER HANDBOOK: A MANUAL OF THE COPPER INDUSTRY OF THE WORLD. Compiled and published by Horace J. Stevens. Vol. VIII, pp. 1500, index. Houghton, Mich., 1908. Price $5.

This indispensable guide to the activities of the copper world for the year 1908 has just been issued, with 272 pages in excess of the number contained in the preceding volume. The increase has been due almost entirely to the need of room for details of new companies, which shows a substantial growth, despite hard times. The work of compiling has been done with that scrupulous care which has distinguished the previous work of Mr. Stevens—work which has made 'The Copper Handbook' recognized as a reliable guide to the subject, rather than a mere compilation of self-praise submitted by weak companies and sparse data relating to important concerns, after the habit of some other company directories. Mr. Stevens has assumed the critical attitude of the editor, seeking and publishing information with due regard to the importance of the operations recounted, and fearlessly exposing fraud and mismanagement. It thus becomes a responsible publication, with statements the accuracy of which it is prepared that the courts shall test. It sometimes results in spicy paragraphs, as for example where it scores both the Government and Douglas, Lacey & Co. (p. 638), in the following terms:

"Efforts, begun November 1903, to have the methods of this firm investigated by the United States Postal Department, have come to naught, although the matter was pushed persistently, and finally was taken to the President of the United States, and by him referred back to one George Bruce Cortelyou, then Postmaster-General, and later Secretary of the Treasury of the United States, who 'investigated' the firm by advising them privately of the charges against them, and accepted their answer, which was that 'The Copper Handbook' is a blackmailing publication, this answer being perfectly satisfactory to the Hon. Mr. Cortelyou, best known as the gentleman who 'fried the fat' out of sundry insurance companies and other corporations, for the presidential campaign of 1904."

Thos. W. Lawson's operations at Trinity are characterized as a "scientific little game for parting fools from their money," with more of like uncomplimentary flavor. The wild-cats are mercilessly scored throughout, and any prospective investor in copper stocks who does not take the trouble to look up the record of the alluring company in 'The Copper Handbook' is rushing on in wilful blindness. There is one suggestion we would make for future editions, namely, a geographical index of mines, so that a person purposing to visit any particular State or county might have a guide to all the properties in that locality.

MILLWRIGHTING. By James F. Hobart. 8vo., pp. 401, Ill., index. Hill Publishing Co., New York. 1909. Price $3.

The millwright is not a book-made man; his skill is the result of knowledge acquired in practice; his is a trade. Hence any millwright will know more than any other millwright will put into a book. But no two men's information is compressed within the same dimensions, and Mr. Hobart has given much that will help his brethren. He has done his work well, and we commend especially the chapters on Laying Out Shafting, Putting Pulleys in Place, Belts and Belting, and Steam and Water Pipe Fitting. The discussion of foundations, erection of structures, and strength of materials is too superficial to yield more than an occasional practical hint.

INVESTIGATIONS RELATING TO CEMENT AND CONCRETE MATERIALS. By G. C. Martin, L. J. Pepperberg, and Charles Butts. U. S. Geol. Surv., Bull. 380-J, pp. 34. Washington, 1909.

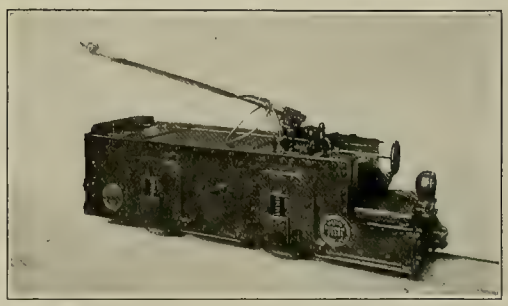
INVESTIGATIONS RELATING TO BUILDING STONES. By Sidney Paige. U. S. Geol. Surv., Bull. 380-I, pp. 17. Washington, 1909.

INTERNATIONAL MINING MANUAL. Advance sheets, Alaska to Colorado. From the Directory for 1909.

BELLE FOURCHE FOLIO (S. Dak.). U. S. Geological Survey, Washington. 1909.

Electric Mining Locomotive for Japan.

The Baldwin Locomotive Works have recently built three electric mining locomotives for the Ishikari Coal Co., of Japan. These are compact machines, designed for a track gauge of 1 ft. 8 in. The approximate weight is 6000 lb. The electrical equipment was supplied by the Westinghouse



Electric & Manufacturing Co. The frames of the locomotives are of steel plates, strongly reinforced by angle irons, which are riveted on. The pedestals are of cast-iron. The frames are placed outside the wheels, and the weight is transferred to the journal boxes through coiled springs. The wheel base is 3 ft. 6 in., and the wheels are 20 in. diam., with 2¾ by 4 in. journals. The motors are classed as No. 64; they are wound for 500 volts pressure, and are inside hung. The trolley pole socket is placed on the centre line of the locomotive, near the front end. The clearance dimensions are as follows: width, 2 ft. 11⅝ in.; height, 3 ft. 5½ in.; length, 8 ft. 9 in. The equipment includes hand brakes, sand boxes with spouts for all the wheels, and two electric headlights. The locomotive is operated from one end only, and due attention has been paid to arranging the fittings so that it can be conveniently handled.

L. VOGELSTEIN & Co., of New York, give the following figures of German consumption of foreign copper for the months January to March, 1909:

	Tons.
Imports of copper	36,105
Exports of copper	2,075
Consumption of copper	34,030

Of the above quantity, 33,291 tons were imported from the United States. Consumption during the same period in 1908 was 42,830 tons.

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EDITORIAL.

CONGRESS is tediously laboring to reduce the tariff without interfering with the joy of the trusts.

WATER has been turned into the Yukon ditch, and the reward of careful planning and much hard work is at hand. Our congratulations to Mr. O. B. Perry and his fellow engineers.

SALISBURY WASH is the latest centre of enthusiasm in Nevada. Reports of extraordinary discoveries of silver-gold ore are drawing hordes of excited fortune-hunters. The new camp lies about thirty miles east of Tonopah and is seven miles from Clifford. It has just been re-christened Ellendale.

SIBERIA has no further attractions for Mr. Jafet Lindeberg, who has given up his contest with the Russian Government over seizure of his claims in the Anardirf country. This is unfortunate, as Mr. Lindeberg is an able man, of the type that could aid most in developing our neighbor's great resources. Before passing harsh judgment on the Russians, however, it would be well to remember that at Nome the Americans have no very enviable record for giving exact and prompt justice.

WAR kills off the able and leaves the drones behind; the inheritance of war is therefore decadence. So teaches a certain school of disarmament enthusiasts. The argument is alluring; it hits the whole race; for we are all descendants from the lucky survivors of incorrigible fighters. It therefore becomes invidious to single out a particular nation for uncomplimentary mention, as did Dr. David Starr Jordan in a recent Commencement address. There was an offended French professor on the platform, and a hitch in the proceedings, which either wit, tact, or courtesy, might have averted. Debate as to the facts might have been interesting; someone could have suggested the marvelous leadership in metallurgy which the French have recently displayed, to go no farther afield; and another, remembering a book on evolution which the learned Doctor has just published, could have made pertinent query why the cultivation of a propensity, even for war, may not develop the heroic faculties. Who knows?

ALASKA has a new Governor, Mr. W. A. Clark. The selection of a newspaper man for this position has much to recommend it. Our 'non-contiguous continental possession' is governed by a peculiar system, having judicial and executive but no legislative department. Practically the Federal Judges are the ruling powers, and Mr. Edward E. Cushman, who took the oath as Judge of the Third Division of

the Federal Court of Alaska at Tacoma June 6, will have more actual power than Mr. Clark. The duties of the Governor of Alaska are varied. Perhaps his most important function is to make recommendations to the Washington Government. The force of these depends on his character and standing, and the care with which he has studied the situation. We are glad to assure our Alaskan friends that Mr. Clark has, among his associates, a high reputation for character and ability. As a trained newspaper writer, familiar with affairs at Washington, he should be peculiarly able to determine the drift of local opinion regarding the needs of the Territory, and to command the support necessary to the adoption of his recommendations. Alaska has been often shabbily treated at Washington, but we hope better times are in store.

ARREST is a needlessly harsh measure for enforcing the collection of taxes. The indictment for conspiracy of the officers of the Pittsburg Silver Peak and the Florence Goldfield companies in Nevada, as detailed in our special correspondence, savors of comic opera. The bullion tax is a personal one, assessed on net returns. That there is abundant room for honest difference of opinion as to what are legitimate charges and what constitute net returns, is clear to anyone who has tried fairly to distribute charges between operating and capital accounts. We do not know the details in this case, but Mr. Edmund Juessen and others mentioned are not the sort that indulge in dishonest practice. If the particular division of accounts adopted by the companies concerned is not correct, the easy remedy is a civil suit to recover. In this case there is abundant tangible property to make such a suit worth while. Tax laws are enacted to produce revenue. If mining engineers are to be arrested whenever their ideas of bookkeeping fail to agree with those of the local grand jury, their life bids fair to be more exciting, if not so attractive.

SLIME is one of the least comprehended products with which the millman has to deal. It has baffled him persistently. Yielding neither high recovery of minerals in concentration, nor of metals by lixiviation, it has remained a constant cause of loss; yet the problem has not been approached in a scientific manner by metallurgists. Attempts to control slime have been made empirically, and the successes achieved have mostly been lucky accidents. The nature of the material has not been sufficiently investigated. The clay-workers, meanwhile, have been probing the mysteries of similar complex substances which they call 'slips', and this week we print a remarkable article from the pen of Mr. Harrison Everett Ashley which will afford a glimpse into a new field of research for the producers of gold and silver. The clear statement of the reason why lime as a settling agent has been so puzzlingly erratic, will attract wide attention. Mr. Ashley might have drawn further from his acquaintance with this matter and have told how our methods of grinding increase the colloids in ore-pulp, opposing the most serious of obstacles to high extraction. The article, in fact, is only a brief introduction to a subject on which data have already been accumulated that will mean millions of dollars annually to the precious metal miners when applied to their milling processes.

ACCIDENTS in mines are inevitable. The most abundant precautions and most stringent rules merely serve to reduce the number. The burden of caring for the injured is not removed. In order to make each industry sustain its own obligations, counting such items as part of the cost of production, an effort is now being made by a tonnage tax, to provide for those maimed, and to care for the widows and orphans of those killed in coal mines. The need of some protection in these mines is especially urgent because of the high accident rate and low yearly wage, though doubtless success here will lead to similar demands in other mines. The equity and the economy of the move are more apparent than the legal means of effecting the change. The American Mining Congress has taken the lead by appointing an able committee to prepare a suitable statute for presentation to the State legislatures. In view of the close competition between the coalfields of the various States, immediate results can hardly be anticipated. The resulting agitation of the question will at least focus attention on an important problem.

Moisture in Coke.

Coke is now being purchased on the basis of net dry weight by the smelters on the Pacific Coast. This has aroused much opposition from foreign shippers. Australian coke is usually low in moisture, but the European contains generally about eight per cent. The smelters allow three per cent without deduction from the gross weight of the coke. The determination is made upon fifteen-pound samples crushed to a half inch, dried in a steam-heated dessicator at a temperature of 240 degrees Fahrenheit. The samples are said to check within less than two-tenths of one per cent, which appears remarkable. It would seem that the rate of re-absorption on cooling would vary within wide limits, depending upon the relative friability of the coke. Also the moisture in the air would ordinarily differ enough to preclude agreement with an umpire, unless the samples were tested at the same time and place under identical conditions. It seems manifestly unfair to charge for material not delivered, but this is only one phase of the problem involved in reaching a fair valuation of a fuel. When attempting to sell fuels on a scientific basis a host of difficulties arise. The method of determining the objectional constituent is open to scrutiny. If the moisture be absorbed prior to shipment the consumer must inevitably, in one way or another, pay the freight. Once the game of deductions, or penalizing, has been fairly inaugurated, technologic finesse will discover additional points of vulnerability in the coke-maker's armor. Not only is moisture not carbon, but it consumes carbon to expel it; the coke-manufacturer therefore must submit to a lopping off at each end to arrive at the net weight. It were to inquire too curiously, perhaps, to consider the loss from oxidation facilitated by the absorption of moisture.

Seriously, the move is in the right direction. The purchase of net dry coke will soon become universal. Why an allowance of any percentage of moisture should be made we do not see. The restriction as to quality will necessarily be met by a corresponding increase in the price on the net-weight paid for, for manifestly the freight on the water must be paid by someone. Coke will take up water in proportion to the relative dryness of the air, and drying of the coke prior to shipment would be of no avail.

Opportunities in Asia Minor.

Under the new régime progress may be anticipated in Turkey, and a great area in Asia Minor will be available for development. Within this region lay ancient Cappadocia, where the copper industry as a nursling in the early days of Indo-European man yielded bronzes that inaugurated a new era in human culture. The copper resources of that district are known only in a general way, but the indications point to extensive deposits. It is a region of wild mountains inhabited by tribes which have repelled the advances of strangers. Gold, lead, silver, mercury, coal, and iron abound. The Arghana mine is one of the oldest in the world that has been continuously worked. It was opened in the year 1096 A.D., and was described as a famous producer of silver by Omar the Traveler at the beginning of the twelfth century. This does not, of course, go so far back as the Laurium mines of Greece, which reckon their age by milleniums, nor does it equal the antiquity of the Rio Tinto in Spain, which still gives a controlling power in the copper market to the English corporation that owns it. Freiberg and Przibram also claim great age, but eight centuries of continuous operation under the barbarous conditions which haye had to be combatted in Asia Minor proves the existence of a deposit of remarkable character, one that incites the miner to hope for many others which will prove amenable to modern methods. It is unquestionable that the new ruler of Turkey, coming to the throne pledged to reform, will infuse a progressive spirit throughout his dominions. It is therefore to be expected that liberal laws will invite the unfolding of the mineral deposits which have remained dormant for centuries. In so far as possibilities of exploitation by twentieth century methods are concerned, it is a virgin field. The article on 'Mineral Resources of the Turkish Empire', by Mr. Leon Dominian, published in this issue, will be of great value to that growing number of investors for whom no corner of the world is too far away if profit be in sight. Asia Minor is becoming readily accessible through railroad construction. The Anatolian line, under German management, starting from Constantinople, strikes across the upper peninsula to Aintab, where it divides, one branch continuing across the desert toward Bagdad, which city is now nearly reached by the rails; the other branch swinging through a series of wadys behind the coast range which parallels the Mediterranean, to Mecca. Asia Minor is a land of remarkable opportunity, and he who has courage to enter early should reap proportionate benefit.

American Securities Abroad.

That France takes banker's toll from the world has become appreciated by our people during the recent financial stress; that France has stood financially sound while tremors passed through every other great industrial nation in the world has been an impressive spectacle of the last two years. One is reminded by it of the unlimited resourcefulness of the French which so astounded Bismarck. Having by superior military power forced his way to the Tuileries, he sought to crush the country under the load of a preposterous war indemnity, aggregating nearly four billion dollars, but within a few short years the sum was paid, and France has continued financially impregnable. She effects exchange for the whole of Europe; like a great lake the financial streams of the Continent flow into and out of France; the floods are equalized, and the great fluctuations, so characteristic of American securities, are not seen abroad. Stocks and bonds, once listed on the Paris Bourse, are known to have been severely scrutinized. Behind them exist substantial assets and demonstrable earning power. Dependableness is the quality demanded by the managers of the Bourse. In America the speculative feature has dominated the financial and industrial system; hence the wild flight of prices, the upward sweep from sudden enthusiasm, and the collapse after the manipulators unload upon the credulous public. Capitalization here is usually based upon highly speculative estimates of value and profit. Hence not a single American security had ever been accepted on the Paris exchange until Mr. J. P. Morgan the other day, through Morgan, Harjes & Company, listed one million shares of the United States Steel common stock on the Bourse. This is one of the most notable events in our financial development, and will have a far-reaching influence. A new standard of stability will be set for our industrials. The further this listing proceeds, the narrower will become the range of general quotations. Steel common has been rising rapidly. A month ago it was 54; at the end of May it stood at 59, the highest on record up to that time; since then it has mounted to 69, steadying a little within the week. This has been due partly to the prospective increase of income from the forty-nine million dollars expended out of surplus in constructing the Gary plant, and partly to the effect of the new Continental market opened through the generalship of Mr. Morgan. It is believed that one purpose of Mr. E. H. Harriman's visit to France is the listing of the stock of the Southern Pacific on the Bourse. With the retirement of the preferred shares, and the large increase in earnings, it would seem to be acceptable. This new phase in American stock transactions will benefit our industrial enterprises in general, and will open new investments to Europe. Perhaps nothing could have happened that would so surely cause a business revival. In view of the influx of foreign capital resulting from the purchase of American securities abroad, great activity may be confidently predicted to follow immediately. Possibly the recent energy displayed by those controlling the copper industry was promoted by anticipation of such European aid.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

H. W. HARDINGE was in San Francisco.

PERCY E. BARBOUR has gone to Salt Lake.

FRANK W. OLDFIELD has been in San Francisco.

JAS. M. HYDE is living at Palo Alto, California.

H. S. DENNY is in the Black Hills, South Dakota.

C. S. HERZIG is at the Babilonia mine, La Libertad, Nicaragua.

L. I. OGDEN is inspecting State work at San Jose, California.

V. FRANK TAYLOR is returning to London from South Africa.

G. S. CORSTORPHINE has returned to South Africa from London.

J. W. FINCH, of Denver, has gone to Butte, Mont., and Wallace, Idaho.

H. C. WILMOT has opened an office in the Newhouse building, Salt Lake, Utah.

ARTHUR C. FOX is superintendent for the Duluth-Pacific Copper Co., at Clealum, Washington.

E. J. CLARK has resigned the position of superintendent of La Palmilla mine, Parral, Mexico.

ROBERT SCHORR has moved his office from 61 Fremont street to the Postal Telegraph building.

JAMES BROWN, representing the Tharsis Sulphur & Copper Co., Ltd., was in San Francisco this week.

L. A. WOMBLE is general manager for the Van Dyk Proprietary Mines, Ltd., Boksburg, Transvaal.

W. PELLEW HARVEY has returned to London after professional visits to New South Wales and to Northern India.

J. A. GRENFELL, chairman of the directors of the Messina (Transvaal) Development Co., Ltd., is visiting the Rand.

WM. FRANK GRACE has left London for New Zealand, to make an examination of the Waihi Grand Junction mine.

H. B. VAILE, of Tunbridge Wells, England, has been visiting the Humboldt-Nevada Mines, Ltd., properties, at Chafey, Nevada.

G. M. ROBERTS of the Associated and the Associated Northern Blocks, Kalgoorlie, Western Australia, has gone to London.

FERGUS ALLEN, manager for the Mexico Mines of El Oro, Ltd., who has been in the hospital at Mexico City, is convalescent.

CHAS. G. YALE, E. W. PARKER, and M. R. CAMPBELL, of the U. S. Geological Survey, left for the East by way of Seattle this week.

E. G. WOODWARD, who has had extended experience in Africa, is consulting engineer to the Ozark Diamond Mines, in Arkansas.

THOS. NUTTAL MILLER, now of the Bullychoop Gold M. Co., will take charge, July 1, of the Texas Jack mine, in Trinity county, California.

MALCOLM MACLAREN is making an examination of mines at Kalgoorlie, Western Australia, and expects to be absent from London six months.

LOUIS A. WRIGHT has been appointed consulting engineer in the Southwest and Mexico for the General Development Co. and to the Miami Copper company.

JAMES S. DOUGLAS, manager for the Phelps-Dodge interests in Sonora, Mexico, has resigned and will spend a year visiting the principal copper mines of the world. He is succeeded by J. S. Williams, Jr.

Obituary.

FRANK A. LUCY, a mining engineer who was appointed superintendent of the Florence Goldfield Co., at Goldfield a few days ago, fell down a shaft on June 7 and was instantly killed. He leaves a widow.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, June 10.

Antimony	12–12¾c	Quicksilver (flask)	44–45
Electrolytic Copper	15¼–16¼c	Spelter	6½–7¼c
Pig Lead	4.60–5.55c	Tin	32–33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 3. £ s. d.	June 10. £ s. d.
Camp Bird	1 2 3	1 6 6
El Oro	1 6 3	1 6 3
Esperanza	2 18 9	2 18 9
Dolores	1 10 0	1 10 0
Oroville Dredging	0 13 9	0 13 0
Mexico Mines	5 12 0	6 0 6
Tomboy	1 1 6	1 2 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 4	13.37	4.27	5.28	53
" 5	13.37	4.27	5.31	53¼
" 6	Sunday.	No market		
" 7	13 43	4 27	5.33	53
" 8	13.43	4.27	5.36	52¾
" 9	13.50	4.27	5.42	52⅞
" 10	13.50	4.27	5.42	52⅝

MINING QUOTATIONS—NEW YORK.

	Closing Prices. June 3.	June 10.
Amalgamated Copper	87⅛	86¼
American Smelting & Refining Co	96¼	95⅜
Boston Copper	15⅜	15⅜
Butte Coalition	26½	—
Cumberland-Ely	8¾	7½
Dolores	5	4¾
El Rayo	2	2¼
Giroux	7⅜	7½
Greene-Cananea	10¾	10⅝
Indiana Sonora	3	3⅛
La Rose	7½	7¼
Miami Copper	14⅞	15
Nevada Consolidated	22⅞	22⅝
Newhouse	2¼	2
Nipissing	10¾	10⅝
Ohio Copper	4⅛	4⅞
Tennessee Copper	42	41½
Utah Copper	52	52¾
Yukon	5	4¾

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. June 10.		Closing Prices. June 10.
Adventure	8¼	Mohawk	67
Allouez	44½	North Butte	61¼
Arcadian	4¾	Old Dominion	56
Atlantic	9½	Osceola	158
Calumet & Arizona	108½	Parrot	35⅝
Calumet & Hecla	675	Santa Fe	2½
Centennial	24¾	Shannon	16⅝
Copper Range	84	Superior & Pittsburg	14¼
Daly-West	7⅞	Tamarack	73
Franklin	17¾	Trinity	12½
Granby	105	United Copper Con	10½
Greene-Cananea, ctf	10⅝	Utah Con	44½
Isle Royale	28½	Victoria	4¾
La Salle	13⅜	Winona	6
Mass	9½	Wolverine	150

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, June 10.

Atlanta	$ 16	Mayflower	$ 9
Belmont	83	Midway	22
Booth	13	Montana Tonopah	68
Columbia Mtn	11	Nevada Hills	1.00
Combination Fraction	66	Ophir (Comstock)	1.35
Daisy	34	Pittsburg Silver Peak	49
Fairview Eagle	18	Rawhide Coalition	27
Florence	3.35	Rawhide Queen	30
Goldfield Con	7.90	Round Mountain	75
Gold Kewenas	11	Sandstorm	10
Great Bend	8	Silver Pick	12
Jim Butler	14	St. Ives	11
Jumbo Extension	12	Tonopah Extension	50
Llanos Con	75	Tonopah of Nevada	7.00
MacNamara	29	West End	26

General Mining News.

ALASKA.

KETCHIKAN DISTRICT.

The Victor Copper Mining Co. has a group of 18 patented claims on Gravina island, on which there are several parallel veins of copper iron ore, some of which are contacts between blue limestone and greenstone. The ore is chalcopyrite in a quartz gangue. Much of it is high-grade, and an estimate of the general average places it at 8% copper. To open and develop the property a 6 by 8-ft. cross-cut is being driven, which will intersect the principal contact 2100 ft. below the surface. It starts 40 ft. above tide-water and the work has progressed 550 ft., in the course of which three minor veins have been cut; but to intersect the main orebody the cross-cut must be driven 900 ft. farther. The work is in charge of Patrick Heaney, who states that a steam boiler and a 5-drill air-compressor of the Rand make have been purchased and that this equipment will be installed and in operation by August 1. The work on the cross-cut will then continue till it is in 2000 ft. The Victor company is a close corporation made up of Kansas City and Butte men. The ore carries a small amount of gold.

ARIZONA.

COCHISE COUNTY.

The Princeton Mining Co., whose property is situated in Ramsey canyon, in the Huachucas, has resumed operations. Frank Littlejohn is superintendent.——Development work on a number of prospects around Benson is exposing ore near the surface. This is carbonate, malachite, red oxide of copper, and some gold. North of Benson some free-milling quartz has been found.——A body of lead carbonate ore was encountered by a cross-cut on the Comanche Chief claim at Duncan. John A. Duncan is the owner of the claim.——A lease and bond has been secured on the Railroad Exchange claim by John Cross and John Buford. The ore is lead-silver and will be shipped to the El Paso smelter.

GILA COUNTY.

The structural steel and a large portion of the machinery has been ordered for the plant of the Miami Copper Co. The mill, which is to have a 2000-ton daily capacity, will be started at 1000 tons and gradually worked up to its full output. It will be constructed so a 1000-ton unit can be added at any time the mine output may warrant.

GRAHAM COUNTY.

The Shannon-Arizona railway has awarded the contract for the grading and construction of the new railroad, which will be 10 miles in length connecting the Shannon smelter with the mines at Metcalf. All tunnels, bridges, and grading will be done for a standard-gauge road, though at present the company plans the laying of a narrow-gauge track.

YUMA COUNTY.

A contract for the building of a $1,000,000 smelter with a 300-ton daily capacity at Parker has been let. The construction will be begun as soon as a spur track from the Arizona & California railroad has been completed.

CALIFORNIA.

BUTTE COUNTY.

The injunction against the Indiana Gold Dredging Co. has been removed and the suit between it and the city of Oroville compromised. The dredging company agreed to pay costs of suit and to level the piles of tailing that were held responsible for last winter's floods.

INYO COUNTY.

The Casa Diablo Mining Co. has received a shipment of electrical machinery from the Pittsburg Transformer Co., consisting of three large and three small transformers. The large ones will be placed at the company's hydro-electric plant on upper Owens river and the small one at the mine. The hoist, compressor, and mill are run by electric-power.

MONO COUNTY.

The suit which has delayed the work in the Mono oilfields has been settled and drilling will be resumed. The Great Western Oil Co. has a well down 1600 ft. and will continue sinking. This well passed through three oil-bearing strata.——The Sierra Co. will start work on the shore of Mono lake.——The Mono Standard Co. struck gas at a depth of 300 ft. that stopped work temporarily.

NEVADA COUNTY.

The Fairview mine near Washington continues its phenomenal production. Eight thousand dollars has been taken out of a raise that is being driven to the surface for an air-shaft. Arrangements will be made shortly for the erection of a 20-stamp mill.

PLACER COUNTY.

The shaft at the Orpheum mine is down 100 ft., and it is the intention of the management to sink 60 ft. more to the adit level. C. E. Peach is superintendent.

SAN BERNARDINO COUNTY.

A. L. White and associates of Lima, Ohio, have taken a bond and lease on the Gold Bar and Gold Bronze mines in the Vanderbilt district for $500,000. The lease runs over a period of two years. The Gold Bronze shaft is 400 ft. and the Gold Bar 500 ft. deep. The ore assays about $30 per ton and it is estimated that 200,000 tons is blocked out. The properties have been idle for five years, being tied up in an estate. The Gold Bronze 10-stamp mill will be put into shape to handle the ore.——A shoot of ore running several inches wide and assaying from $100 to $400 per ton has been uncovered in the east drift of the Amalie. The main vein continues to run about $40 per ton. The high-grade will be shipped to the Selby smelter and the milling ore stored until a mill is erected.——The Piute Consolidated Mining Co. has placed an order for a 6-stamp mill and is considering the installation of an aerial tramway to connect the mine and plant.

SHASTA COUNTY.

Four steel cars for the Old Diggings railroad and four scale and two steel gondola cars for the Mammoth Mine railway have been ordered by the Mammoth Mining Co. At their smelter two large settlers will be added and a conveyor for handling low-grade matte installed.——The El Dorado mine in the Tower House district has been sold to W. H. Roller.

The railroad from Delta to the Delta mines on Dog creek is expected to have the line in commission within a few weeks.——The Afterthought Co. is again considering the building of a railroad from Ingot to Anderson by way of Bella Vista. The road has been surveyed and partly graded. The Afterthought mine and Ingot smelter will resume as soon as the road is completed.——One furnace is in operation at the Balaklala smelter and one converter stand.——Active work is going on in the Bully Hill and Rising Star mines and two furnaces are in operation. The Mountain Copper Co. is driving a new adit at the Iron Mountain mine to open a large section of territory that has been carefully tested with diamond-drills. About 100 men are employed in the mine. At the Hornet developments are going on with a small force.

SIERRA COUNTY.

L. P. Woodbury, manager of the Red Star and Rainbow mines at Alleghany, has interested Colorado capitalists in that district and has secured funds for the financing of those properties. The drift will be driven ahead on the vein and a cross-cut started toward the Sixteen-to-One and Twenty One mines.

The Alaska mine at Pike City is to install a new air-compressor.——The mill at the Willoughby mine above Gold valley is being overhauled and will be started soon to crush the ore that was blocked out in the mine last winter.——The Golden Scepter gravel mine is to be started as soon as the snow will permit. M. M. Vineyard will be in charge of the work.——The Bellevue mine is taking out some very rich gravel. The company owns a mile and a half of the channel that is still unworked. A portion of this is in Plumas and a portion in Sierra county.

YUBA COUNTY.

The hull of the largest gold dredge constructed was launched on June 5 at Marigold, a new mining town on the Yuba river. The equipment was made at Marysville and will be installed within the next three months. A depth of 80 ft. will be reached and the amount of gravel handled will be 30% greater than that handled by the other dredges in this vicinity. The approximate cost is $200,000.

The Guggenheims have closed a deal for the purchase of 160 acres of the Henry King ranch near Bangor, situated partly in Yuba and partly in Butte county. They will develop the land for gold and platinum.

COLORADO.

CLEAR CREEK COUNTY.

Some time during the present month the 500-ft. level of the Virginia City shaft workings will be tapped by the Lincoln Mtn. adit. The bore has been driven for 1500 ft., and surveys show that the objective lies less than 30 ft. distant. F. A. Maxwell is manager.——The Burleigh adit compressor plant has been started, and a number of lessees holding privileges on the Phillips vein have brought machine-drills into use. Hancock & Co. will start shipments of lead-zinc ore to the various custom mills of the district during the next two weeks. Stoping is in progress upon a body of ore that is from 18 in. to 3 ft. wide.——The Scotia mill is to be started at an early date by E. F. Byers.——Farragher & Co., leasing below the 240-ft. level of the Astor mine on Democrat Mtn., shipped 15 tons of second-class ore, the return of which was 97 oz. silver per ton.——Oklun Bros., owners of the Scott property on Republican Mtn., have started a shipment of 20 tons of lead ore. Stoping is in progress and a body of ore is exposed that is from 8 to 16 in. wide, for a length of 75 ft.——The Geneva Extension M. M. & T. T. Co., operating the Star group of claims in the Peru district, has resumed work. The Star vein has been intersected by the adit, a streak of lead ore being exposed that is from 8 to 12 in. wide. E. K. Cass is manager.——The buildings at the Alice mine have been completed, and a force of men is employed grading for the construction of a 300-ton milling plant. A. H. Roller is manager.

OURAY COUNTY.

With the melting of the winter's snow many of the mining companies are breaking trails and increasing their working force. At the Camp Bird a new orebody 14 ft. wide has been opened. As this is in ground that has not been prospected the length of the shoot is unknown.——The Revenue mine continues in good ore and maintains a steady output.——From the Sneffels district from 65 to 68 tons of ore are being loaded on the cars each day, and at the mines 1000 tons are ready to be shipped by teams and pack-trains carrying the ore to Ouray.——The Savage Bear Gold & Silver Mining Co. has opened the trail as far as the Grizzly Bear in order to start operations on its 17 claims. This company is a Colorado corporation, with F. J. Hulaniski as its president. The Grizzly Bear mill has been leased by the company and will be used in milling the ore from the vein and the dump.

SUMMIT COUNTY.

The Sullivan ranch at the mouth of Swan river is to be prospected by churn-drills to determine its value as a dredging property.——The Reliance dredge has just installed a new bucket-line at an outlay of about $15,000.

SAN JUAN COUNTY.

Machinery for a new mill for the North Star mine has been purchased in Denver and it is expected that the stamps will be dropping in the next few months. T. R. Henehan is superintendent.——George C. Hill has been appointed manager of the Highland Mary mine.——The Gold King Mining Co. has commenced re-building their terminal and tram which was destroyed a short time ago by fire. A new vein has been cut and the mill will be started as soon as the tram is in working order.

TELLER COUNTY.

The mines of the Granite Gold Mining Co., the Dillon, Monument, and Granite on Battle mountain and the Gold Coin in the city of Victor, are operated under the leasing system, and at the present time 30 sets of lessees are engaged in the development of the property. The average value of the ore shipped, including the dump ores, is about $25 per ton. Dividends amounting to $16,500 were distributed June 5. D. L. McCarthy is superintendent.——On a 30-ton shipment from the Morris Bros. lease in the Morning Star mine the return was $40 per ton.——The Humphreys-Thompson leasing syndicate has leased the Necessity claim on Battle mountain.——L. A. Van Tilborg and E. J. Williams, operating a lease between the eighth and fifth levels of the Trilby Mines Co.'s main shaft, have commenced hoisting ore from the seventh level. The ore mined from the main Trilby vein is broken from 5 to 8 ft. wide and is a good milling grade.——The Doctor Jack Pot Mining Co. has declared a dividend of ½c. per share. The Jack Pot shaft has been re-timbered and the ore will be hoisted through it instead of the old leasing company's shaft.——Joe Couse and partners, operating a lease at the ninth level of the main Wild Horse shaft, have opened an ore-shoot southeast of the shaft and are breaking from 12 to 15 tons per day of milling ore that is estimated at $12 per ton.——Sinking has been resumed at the main shaft of the Requa Savage Gold Mining Co.'s property on Beacon hill, by the Evelyn Leasing Co. The shaft, now 600 ft. deep, is to be sunk to water-level.——The Altman Leasing Co., operating a five-year lease on the holdings of the Free Coinage Gold Mining Co. on Bull hill, started its new hoisting plant. The leasing company is sinking the Pinto shaft from the 550-ft. level. A station will be cut at the 850-ft. point and the first lateral work by the leasing company will be carried on from that point.——Charles Hathaway, operating a sublease on the American Eagle mine, shipped 30 tons of ore for a trial run.——The monthly measurement of the work performed under the Carlton contract at the Roosevelt Deep Drainage Tunnel shows a total distance driven during May of 954 ft. The distance gained at the Portal heading in the last half of the month established a new record for tunnel driving, in that 246 ft. were run in 15 days.——The Roscoe Leasing Co., operating the Victor mine on Bull Cliffs under a sublease from the Western Investment Co. of Victor, billed out between 450 and 500 tons of ore during the past month, of an average value of $15 per ton.

IDAHO.

BONNER COUNTY.

The St. Lawrence mine on Antelope mountain shipped five cars of ore on which the smelter return was 16 oz. silver and 75% lead. Joseph Reed is manager.

IDAHO COUNTY.

A diamond-drill is to be installed on the Thunder Mountain Gold Co.'s property on Crooked river. A. R. Balcom is in charge of the operations.——The Horse Shoe Bend placers have been purchased by S. A. Wilson and lumber has been ordered to build a flume to bring water for the giants.——Three feet of free-milling gold ore in a 5-ft. vein has been encountered on the Last Chance Mining Co.'s property in the Elk City district.

SHOSHONE COUNTY.

A saw-mill and six-drill compressor has been ordered for the Interstate mine in the Coeur d'Alene district. Oscar Wallace is manager.——The Idaho Copper Mining Co. has installed a steam-driven three-drill compressor and will install another shortly. A 7 by 9 ft. shaft is being sunk to intersect the vein.——Surveyors for the Idaho Northern Railway Co. are running a line up Beaver creek to tap the Sunset district. They are also surveying to get the grade for a line up the Little North Fork, 12 to 15 miles. There are several good copper properties on this stream on which little development work has been done, owing to lack of transportation facilities.——A good shoot of ore was cut on the 1650-ft. level of the Standard mine at Mace.——The Snowstorm mine at Larson is shipping 10,000 and 12,000 tons of ore per month. Shipments have been curtailed for some time on account of the low price of copper.——The adit of the Teddy Mining Co. cut a vein of chalcopyrite ore

when in 350 ft. The adit will be continued to cut a lead-silver vein 300 ft. farther ahead. J. B. Cox is president of the company.——The Government Gulch Mining Co., near Wallace, has awarded a contract to sink the shaft 100 ft., which will give the company a depth of 200 ft. The company has also awarded a contract for 100 ft. of driving. Some good-looking galena ore was found on the 100-ft. level and it is planned to tap this at greater depth.

MICHIGAN.

Mass has reached the new lode in its cross-cut on the thirteenth level, and the showing is said to be satisfactory. Six hundred and fifty tons of ore is ready for a mill test. ——Upon the announcement that the Mass Mining Co. had encountered a good copper-bearing lode at a depth of 1700 ft., the mine management of Adventure, which adjoins the Mass property, immediately began investigations on its side of the dividing line, with the result that on the surface it also encountered what appears to be the same lode. Work will commence shortly by the Adventure Co. on two cross-cuts for the purpose of intercepting this lode at depth. Last year the Adventure commenced diamond-drill operations in the hope of finding some new and profitable lodes. In that search the Mass lode was encountered, but the showing made at that time did not seem to warrant further examination. Three other lodes were also brought to light, one at a depth of 1200 ft., the second at 1500 ft., and the third at 2700 ft. These are entirely separate and distinct from the Mass find. The new vertical shaft will be sunk soon to open these orebodies.——The managements of the Winona and King Philip companies have decided to erect a stamp-mill for the joint use of both companies on King Philip territory, midway between the two mines. Excavating on the site selected, preliminary to the laying down of the foundations of the structure, is now in progress. The mill will have two steam-stamps of 750 tons daily capacity each, and is expected to be ready for service by June 1910. Developments in the Winona mine reveal uniformly good copper ground at and below the ninth level, the ground at depth showing a decided improvement over that opened on the levels above. The company has blocked out upward of 1,500,000 tons of ore ready for stoping. The shaft is sinking for the twelfth level.——Detailed engineers' reports from the Cactus show that a sulphide orebody 200 ft. thick has been demonstrated, with copper content, which averages a little better in copper than Miami and considerably better in silver.——The Lake Copper Co. has entered the lode, with high-grade copper ground, in cutting the station at the fourth level, finding it only 25 ft. from the shaft. It has been cut for a distance of about 8 ft. and is up to the average that has been previously demonstrated in the Lake lode. A diamond-drill is rigged up in the south drift at the second level, about 250 ft. from the shaft, at a place where a trap-rock, believed to be the hanging wall, is exposed.

MONTANA.

FLATHEAD COUNTY.

Placer gravel which runs $2 per yard has been found on Howard creek, a tributary to Libby creek, 20 miles south of Libby. The Howard Gulch Placer Co. has bought 820 acres of placer ground lying along Howard and Lake creeks and has a force of men at work doing development and getting ready for the season's run.

SILVER BOW COUNTY.

The fire and gas in the Anaconda, Neversweat, and St. Lawrence mines, which had its origin in the St. Lawrence in 1889, seems to be spreading. The Anaconda mine had to be shut down entirely in the early part of this month, and the gas interfered with operations in the two adjoining properties—the Neversweat and the St. Lawrence. For several months miners have been engaged in bulk-heading the workings surrounding the fire-zone in the Anaconda mine. The shaft of the Anaconda was abandoned about six months ago, since which time it has been used only as a vent or chimney for the mine, and the mining conducted through the Neversweat shaft.

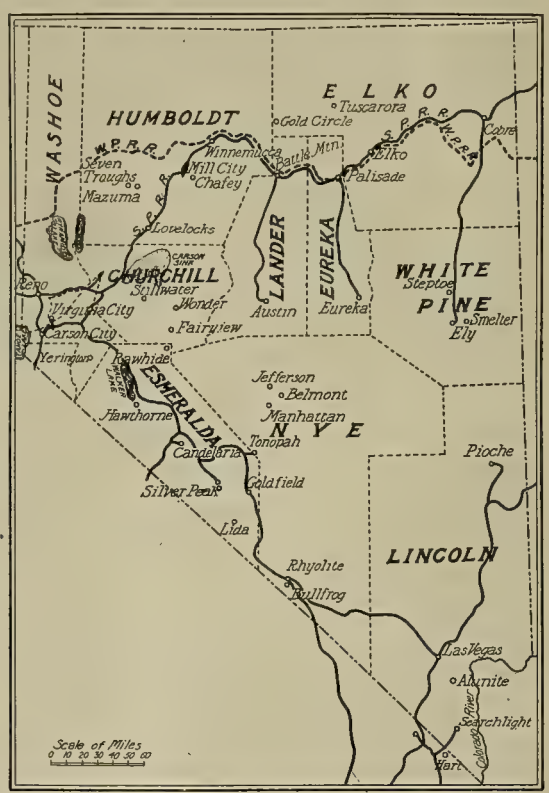
NEVADA.

ELKO COUNTY.

The Oregon Short Line is building from Twin Flats, Idaho, to Cobre, and will furnish transportation for the copper ores of the Contact district. Representatives of both the Guggenheims and the Standard Oil interests have made recent examinations and are both negotiating for a group of over 20 claims. The deepest shaft is on the Brooklyn, where at a depth of 300 ft. an 18-ft. vein has been opened that will average better than 9% copper. The Palo Alto shaft is down 290 feet.

ESMERALDA COUNTY.

Work has been suspended on the Elks Consolidated lease on the Yellow Tiger for a period of 30 days. The shaft is down 707 ft., and it is planned to sink to 1000 or 1200 ft. when operations are resumed. Drifting has been in progress for some time on the 700-ft. level, where a vein 40 ft. wide has been cross-cut, which assays from $2 to $5 per ton. Maurice Starne is manager.——Development of the orebody cut by the Victor shaft of the C. O. D. Consolidated, at the 400-ft. level, is now under way. The ore carries a good percentage of copper, but does not assay well in gold as far as developed. The management has determined to sink another 50 ft., as the vein seems to be somewhat broken at



Map of Nevada.

the 400-ft. level.——The Diadem lease on the Great Bend cut a vein of high-grade ore.——The new shaft of the Nevada Eagles mine has been completed to a depth of 300 ft. The shaft is 8½ by 4½ ft. in the clear, and the machinery will now be moved from the old shaft and sinking of the new will continue to 500 ft.——Shipments from the Marigold lease on the Coalition estate at Rawhide during the last two weeks in May had an aggregate value somewhat in excess of $12,000. All ores at present being mined are coming from the north and south stopes on the 160-ft. level. At that level a cross-cut is now being run east to reach a vein that outcrops about 200 ft. from the shaft.—— An 8-ton consignment of $150 ore from the Proskey No. 1 lease recently went out to the sampler at Hazen. The shipment was mined from the stopes on the 100-ft. level.—— Superintendent Frank McKelvy, of the Victor lease, is pre-

paring for the installation of a 10-stamp mill at a point about 200 ft. west of the shaft.——As the result of the consolidation of the Pittsburg-Nevada and Rialto properties, which has recently been effected, operations have been resumed on the Pittsburg-Nevada. The properties are situated near Knickerbocker mountain, east of Goldfield. A shaft has been sunk to a depth of 264 ft. on the Pittsburg ground, and this will be cleaned out and put in working order.

HUMBOLDT COUNTY.

The Humboldt-Nevada Mining Co., Ltd., of which Edward Stables is manager, is developing a group of 43 claims in the Chafey district. The mine is opened by an adit and shows a vein of gold-silver-lead ore carrying as much as $72 per ton in gold and $13 in silver. A shipment of 20 tons to Salt Lake smelters gave a net return of $47 per ton. English, German, and French capital is interested in the property.

Shipments to the Darby Ore Reduction Co., known as the Harris mill, in the Seven Troughs district, are commencing to come in such quantities as to insure the continuous operation of the mill. The mill has been running one shift ever since it was completed, about a month ago, in order to get it broken in, and the first of the week a second shift was added. E. H. Simonds is temporarily in charge. The mill is now running on Florence ore and will shortly start on 1000 tons from the Fairview. Besides these two there is now in the bins ore from the Hero-Nevada and Prior-Chadbourne lease.——A 280-ft. cross-cut from the 400-ft. level of the Monnette Mining & Milling Co.'s mine has intersected the vein. M. M. Garoutte is manager.

LINCOLN COUNTY.

The shaft at the New York-Searchlight is being sunk at the rate of 5 ft. per day, and the management expects to continue to the 1000-ft. level. A cross-cut is being run from the 200-ft. station.——Fifty-six tons of ore from the Chief of the Hills lease was run through the Cyrus Noble mill. The clean-up resulted in an 8-lb. brick.——The shaft of the Copper Prince mine in El Dorado canyon is down 40 ft. Theo. N. Barnsdale is the owner.

NYE COUNTY.

Thirty miles east of Tonopah a new camp has been established. Salisbury Wash, re-christened Ellendale, is the centre of activity. Some 150 claims have been staked and a town-site located. Ed. Clifford and Joe Nay are the original locators and have a number of claims on the vein, which follows a contact between granite and porphyry. A stringer from ½ to 2 in. wide and 15 ft. long has given samples of almost pure gold, but as yet no development has been done, so the extent of the find is unknown.——The Tonopah Extension Co. started grading for a 30-stamp mill. The mine has been shut down during the construction of the mill.——George L. Bailey, superintendent for the Golden Arrow Mining Co., reports that a strike has been made in the tunnel of the Golden Arrow-Mohawk, about 300 ft. from the portal. The vein is over 6 ft. wide, and is all milling ore, with streaks of high-grade.——The winze from the 200-ft. level of the MacNamara is in good ore. It is in the vein, which is now 6 ft. wide.

WHITE PINE COUNTY.

Both the Nevada Consolidated and Cumberland-Ely have increased their output. A unit has been added to the Steptoe smelter and another one will soon be started, as the output of the mines is greater than the smelter capacity. The diamond-drill on the Cumberland-Ely cut a body of copper ore of good grade for steam-shovel mining.——A lease has been taken on the property of the Ely Hidden Treasure Copper Co. by the Hulse Leasing Co., which will work the lead-silver claim of the group. This property was at one time a large shipper of ore, but nothing has been done on it since the copper excitement several years ago.

OREGON.

BAKER COUNTY.

The Baby M'Kee mine in the Cable Cove district is being re-opened by Oliver E. Conner.——The 10-stamp mill at the Humboldt mine in Mormon basin is nearly completed and will start about the middle of this month.——The dredge J. B. Wetherell is building near Gold Center is to commence operations about June 15.——The Kent Ore Reduction Co. has decided to erect a plant in Washington gulch, six miles from Baker City, for treating low-grade ores. The company will also erect a gas plant, using logs and stumps. Henry W. Kent is manager.

DOUGLAS COUNTY.

A carload of oil-drilling machinery has arrived at Oakland, constituting the first lot of drilling apparatus that will soon be at work in this locality, under the direction of the Standard Oil Co., which will sink several wells near Oakland and in the Sutherlin valley. Representatives of the company have been busy the past month in arranging details and getting the leases signed, and now have about 30,000 acres leased for from one to five years. For years this locality has shown prospects of oil, but not until now has it been possible to take up the development of them, owing to the opposition which the representatives have met with in gaining the concessions asked for. The first well will be sunk on the ranch of James Hunt, one mile east of Oakland.

GRANT COUNTY.

George H. Phillips, of Chicago, is operating the Ben Harrison mine, about 15 miles from Granite, on a lease and bond. On the surface the vein has been exposed in a number of open-cuts, and at one point a shaft was sunk 45 ft. on the vein. From this shaft several tons of ore were shipped to the Tacoma smelter, which were settled for on the basis of $700 per ton.

LAKE COUNTY.

Litigation over the Jumbo Chief claims at Goldberg has been settled out of court and work will be resumed after an idleness of 16 months. A drift has been run 125 ft. on the vein, the assays from which have all been better than $8.——The adit of the Goldberg Butte Mining Co. cut a vein at a depth of 275 feet.

PHILIPPINE ISLANDS.

The complete equipment for a 20-stamp mill arrived at Manila and was forwarded to the San Mauricion mine at Camarines. This shipment, weighing about 130 tons, was the largest consignment of mining machinery ever brought to the Philippines. It includes a 20-stamp mill, concentrator, an electric-light plant complete, and power machinery. President Heise states that the installation will be complete and the plant in operation by the end of 1909.——The Paracale Gold Dredging Co. reports a saving of 644 oz. and the Benguet Consolidated Mining Co., 235 oz. for the month of March.

UTAH.

BEAVER COUNTY.

The mill at the Cactus mine of the Newhouse company is nearly completed and is expected to start July 1.

JUAB COUNTY.

The Little Silver King mine, recently purchased by A. N. Holdaway, is to be worked through a shaft being sunk on the Tintic Standard property.——The drift on the 500-ft. level of the Iron Blossom mine is in good ore which has given uniform assays of copper, gold, and silver.——Contracts were closed by the Montana Mining Co. of Tintic with the F. C. Richmond Machinery Co. for a complete electrical mining equipment for their property. The machinery includes a 125-hp. compressor, an 8 by 10 hoist, drill, a complete ventilating plant, electric motors, transformers, and all other accessories required.——A five-ton shipment of concentrate and ore was sent to the Tintic smelter by the Lehi-Tintic mine. The ore is high in iron and the smelters pay a premium to obtain this as a flux.

SAN JUAN COUNTY.

Considerable work is being done at the new oilfields 24 miles from Bluff and just across the line from Montezuma county, Colorado. Sixteen wells have been sunk in this

district and all have struck oil. The original well of the region, known as the Ellis and Goodridge, is 266 ft. deep. It is a 'gusher', and produces between 600 and 800 bbl. of oil per day. A new town has sprung up in the field known as Goodridge.

SUMMIT COUNTY.

Work has been started to drain the Wabash mine through the workings of the Ontario. A drift from the No. 2 shaft of the Ontario is now driven 900 ft. toward the Wabash and will be advanced till it taps the Wabash workings. Nicholas Treweek is manager.

WASHINGTON.

FERRY COUNTY.

R. G. Howard, president of the San Poil-Republic Smelting Co., operating in Republic, announced that they have bought land for a smelter-site. The land is below the old flume, and north of the No. 3 tunnel of the New Republic mine and is reached by a spur from the Great Northern railroad. By erecting a smelter at that point it will be possible to better mix the copper and iron ores of that section with the silicious ores of the camp.——The Blacktail mine in the Republic district shipped two cars of ore to the Granby and two to the Tacoma smelter. It is expected to ship two cars per day in July.

CANADA.

ONTARIO.

A contract has been let to sink the Le Roi No. 2 shaft from the 900 to the 1200-ft. level. This will enable the Le Roi No. 2 to tap the Le Roi vein on the 1200-ft. level where it dips from the Black Bear ground into the Annie mineral claim. Below the 1200-ft. level it belongs to the Le Roi No. 2. The estimated cost is $60 per foot.——Sixty to seventy tons of ore per day are being treated at the McKinley-Darragh mill, producing about three tons of concentrate. ——The shaft of the Alexander mine is down 165 ft. and a diamond-drill is being operated from that point. As soon as the drilling is completed the shaft will be sunk to the 300-ft. level and cross-cuts run to the vein from the 200 and 300-ft. levels.——The Cobalt Central is to deepen its shaft 50 or 75 ft.——The diamond-drill at the Beaver mine cut two calcite veins that show a small amount of silver.——Compressed air will be furnished to the mines on August 1 by the Cobalt Hydraulic Power Co. from its Ragged Chutes plant on the Montreal river. To bring the air to Cobalt nine miles of 20-in. pipe will be laid. The loop-line will start from the end of the La Rose bridge and will encircle the town, joining with the main line afterward. In the loop and the various branches around Cobalt the pipe will be 12 in. In addition to the loop there will be branch lines by way of the Colonial and the Nova Scotia. Another line will run to Kerr Lake. A pressure of 110 lb. per square inch will be maintained and the following rates per drill per 10-hr. shift has been fixed for smaller customers: One drill, $5; two drills, $4; three drills, $3.50; four drills, $3.13; five drills, $2.80.——In drifting to the west on the 80-ft. level on the No. 5 vein a 4-in. vein of high-grade ore was struck on the King Edward mine on Cross lake.

BRITISH COLUMBIA.

The Nickel Plate mine at Hedley has been bonded by the Daly estate to M. K. Rodgers. The lower levels are now being prospected by diamond drilling.——The Ideka mine on Moresby island, of the Queen Charlotte group, is making arrangements to ship 1000 tons of ore per month to the Tyee Copper Co.'s smelter on Vancouver island. On their April shipment the returns were 7% copper and $3.50 gold. ——The two recently enlarged furnaces at the Granby smelter have been blown in and the work of enlarging two more of the furnaces is under way. This will increase its gross smelting capacity from 3200 to 4500 tons of ore per day. At present Granby is making copper at the rate of about 22,000,000 lb. per year, at a cost of about 9c. per pound.

YUKON TERRITORY.

The water has been turned on in the Yukon Gold Co.'s 70-mile ditch from Twelve-Mile river. The ditch carries 5000 miner's inches and has taken three years to construct. The Yukon Gold Co. is operating seven dredges with power developed from a portion of the water carried by the ditch.

MANCHURIA.

A company has been formed of merchants of Mukden and Kirin to develop copper deposits in the upper reaches of the Yalu and to build a light railway. Connection with Antung will be made by river steamers.——A report from Dalny is to the effect that Belgian prospectors have found valuable gold deposits near Hailungchen. They will probably be worked by Chinese officials.——The Chinese Eastern railway has placed a small order for Fushun coal with the Manchuria railway and will probably secure its supply entirely from that source if it be found satisfactory.——The Chinese Government has commenced development work on the Kaiping coalfields. The work is under the supervision of German engineers.——The Manchurian Exploration Co., Ltd., was registered in February in London and has for its object the acquiring of grants, concessions, and other privileges in Manchuria, Siberia, and to carry on a general mining and development business.

MEXICO.

CHIHUAHUA.

Several carloads of heavy timbers have been received and active work has commenced on re-timbering the main shaft of La Presna mine in Minas Nuevas. This is the Central shaft belonging to the Hidalgo Mining Co. James I. Long is general manager.——From the 300-ft. level of the main shaft at the Cata-Rica mine a 600-ft. drift is being run on the vein, to connect with another shaft. Both shafts are in ore. This contains considerable zinc, but has been successfully concentrated. W. E. Brock is manager.——The Parral mill, which was recently purchased by the American Zinc Extraction Co., has been thoroughly overhauled and the old machinery replaced by new equipment. Water to be used for the concentrators will be pumped from El Tajo mine, a pipe-line having already been constructed. The Tajo mine, for the treatment of whose ores the mill has been built, has been shut down for the present, on account of no available space in which to store ores, the mine being situated right in the city. About 20,000 tons are waiting treatment on the dumps.——The Palmilla and Anexas mines have been purchased from Don Pedro Alvarado by A. J. McQuatters, president of the Alvarado Consolidated Mining Co. The State Government has granted to Mr. McQuatters and James I. Long a concession to establish a large custom cyanide plant at Parral. The plant will have an initial daily capacity of 250 tons.——The work of connecting the lower workings of the San Cayetano with the upper is progressing as rapidly as safety will permit. The old workings are full of water and making the connection is a dangerous piece of engineering.

COAHUILA.

The negotiations entered into between the International Smelting & Refining Co., and the Cia. Metalurgica de Torreon have been suspended and will not be resumed. The price demanded by the Torreon company was more than sufficient to cover the cost of erecting a new and up-to-date smelter.

JALISCO.

The San Pedro Analco Mining Co. has called an assessment of $500 per share, payable in monthly installments of $40 each. The money secured is to be used in completing the company's hydro-electric plant on the Santiago river in the Hostotipaquillo district and in equipping the San Pedro Analco properties with a cyanide plant. Augustin L. Gómez is managing director. The company has worked its ores by the patio process of amalgamation for a number of years.——H. H. Cross and H. W. Young have purchased a 5-stamp mill for the Piginto gold mine in the San Sebastian district. The treatment will be cyanidation, and masonry tanks will be used.

SONORA.

The Porica property, owned by Jim Finch and C. A. Overlock, is now under bond to O. L. Neer.

Special Correspondence.

LONDON.

Mining Share Boom. — East Rand Proprietary. — Zinc Corporation Profits.—Hamilton Tube-Mill.

For the first time in years there is a boom in mining shares on the London Stock Exchange, centered chiefly round South African mines. The amount of activity on the Exchange, in the street, and in brokers' offices is reminiscent of the great Kaffir movement of 1895. The present increase in prices differs from most others in that it is founded on solid ground instead of on vague prospects. The settled state of politics and of the labor market, together with the great decreases in costs, have combined to open up vast tracts of gold-bearing country on the Rand, so that the imagination of speculators is readily fired by the golden prospects for the future.

The first of the big amalgamations on the Rand was that of the Farrar group, by means of which the East Rand Proprietary Mines, Ltd., absorbed its subsidiaries, the Angelo, Comet, Cason, Driefontein, and several others not yet producing. The amalgamation was effected on July 1 of last year, and already several events have proved its advantages. For instance, a fire in the Cason shaft hung up the stamps for a fortnight, but by putting extra pressure on the other three mills the total output of all four was kept up. Then again, an accident in the Angelo hoisting plant prevented ore from being raised for a week or ten days, and similar pressure on the other three mills was resorted to. The output has therefore been regular. During the last six months of 1908, the total tonnage treated was 856,320 tons, the extraction 30s. 7d., the costs 16s. 9d., and the profit 13s. 10d. per ton. The ore reserves on December 31 were over six million tons capable of yielding 29s. per ton. The amount of work done is enormous, and large bodies of ore are being developed. Additional plant is being provided in order to bring the total capacity up to 175,000 tons per month. To provide the necessary money, all surplus profits over one million pounds per year will be devoted to this purpose for 18 months. For the purpose of increasing the development, arrangements have been made with the National Bank of South Africa for an advance of £400,000 at 5½%. It is not to be wondered at that after reading news of this sort the London public should take an interest in South African mines.

The report of the Zinc Corporation for the year 1908 contains some details relating to the Elmore vacuum plant which have not hitherto been published. Some mystification has been caused by lumping together in the monthly returns the profits obtained from the concentration process and from the sulphuric-acid plant. The company makes its own sulphuric acid and sells part of it, but as no figures of production are given in the monthly reports, readers could form no idea as to how much of the profit was due to the Elmore plant, and how much to sales of sulphuric acid. By analyzing the figures in the yearly report a fairly good idea can be obtained. During the ten months, March to December, during which the Elmore plant was running, 49,815 tons of concentrate is reported to have realized £2 9s. 4d. per ton, which brings the receipts to £122,877. In the profit and loss account, the total receipts from the sale of concentrate and profit on sulphuric acid are given as £136,398, so presumably the difference, £13,501, represents the profit on sulphuric acid. The total production of sulphuric acid is given as 3129 tons. Probably one-third of this was used in the Elmore plant and two-thirds sold. The great advantage obtained by de-oiling the Elmore concentrate and treating it on Wilfleys so as to dress out some of the lead is also shown in the report. If the concentrate had been sold without further treatment, it would have brought 36s. per ton. After separating it on Wilfleys, the average price obtained was £2 9s. 4d., an increase which meant an additional revenue of £34,917. The cost of de-oiling and treatment on Wilfleys was £13,575, thus showing a net profit on the re-treatment of £21,342. The company is putting up a full-size experimental Elmore plant for the purpose of investigating the value of other Broken Hill dumps.

A new form of tube-mill, invented by C. R. Hamilton, is being exhibited in London by Messrs. Attwood & Hopper prior to its despatch to South Africa for trial. The construction is the same as an ordinary tube-mill, but the axis of the cylinder is inclined at an angle of, say, 10 to 20°. It does not revolve round this axis, but round a horizontal axis. The bearings are aligned horizontally as usual, but the trunnions are fixed to the ends of the tube-mill at points between their centre and their circumference. When the mill revolves, the pebbles receive an endward motion as well as a revolving motion, and it is stated that in this way additional efficiency is gained. Results of practical tests will be looked forward to with interest.

WASHINGTON.

Zinc Tariff.—Alaskan Placer Claims and Miners' Liens.—Wages in Mines.—Bureau of Mines Bills.

It is evident that the zinc producers will have to fight to get a duty on their ores. When the zinc schedule was reached in the tariff bill it was put aside for further consideration. The paragraph at present in the bill is that passed by the House, providing a duty of 1c. per lb. on the zinc contents of zinc ore and calamine. This was the condition until Theodore E. Burton, the new Senator from Ohio, introduced an amendment to the tariff bill, placing zinc ore and calamine on the free list. It is expected that the discussion on this schedule will come up within two weeks. Two important bills relating to the mining industry in Alaska have been introduced in the House by James Wickersham, of Fairbanks, Alaska, delegate from that Territory. The first seeks to amend the mining laws so that hereafter no placer-mining claim can be located in Alaska in excess of 20 acres, and provides that no group or association placer mining claim shall be located. If any placer mining claim hereafter located shall be found to contain more than 20 acres, according to the bill, the owner may cast off the excess upon any side or end he chooses. If he fails to do this within a reasonable time, any person may locate the excess upon any side he chooses. The bill provides further that no placer claim shall in the future be located by an attorney or agent for another. Section 3 states that upon compliance with the laws of the United States in all other respects patents for mining claims in Alaska shall be issued whether the boundaries of the claim shall conform to the rectangular system of public land surveys or not, but the description in the patent shall be made to conform to the boundaries of the claim as actually located by the miner. In making the survey the surveyor shall set permanently at every corner of the claim a wooden post not less than 4 in. square and not less than 3 ft. high, each post to be numbered and marked with the name of the claim. The second bill provides for the creation and enforcement of a miners' labor lien in Alaska. Under its provision every miner or laborer whose work directly aids in the production of the mineral shall have a lien upon the dump or mass of mineral-bearing sands, gravels, earth, or rocks, and all gold and gold dust, for the full amount of wages for all the time he was employed. Claims must be filed within 90 days after the work is completed.

The debate in Congress over the tariff bill has brought to the forefront the immensity of the mineral industry in this country. The other day one of the Senators submitted a tabular statement showing the total amount of wages paid by the various industries represented in the different tariff schedules, also the total value of the products as arranged by the schedules. These figures show the wages paid in the mineral industry, including of course the manufacture of the ores into products, as $863,558,489, out of a total for the entire country of $2,277,838,543. This is 28% of the total wages paid in the United States.

The United States Supreme Court has just decided that a process can be patented. The decision is expected to put an end to many conflicts. The Expanded Metal Co. had charged Eugene S. Bradford with the infringement of a patent for

the stretching of metal, and the Circuit Court in which the suit was brought granted an injunction prohibiting Bradford from continuing his work. The Circuit Court of Appeals overruled this decision, declaring that patents were not granted on abstract ideas. The Supreme Court overruled the Appellate Court and sustained the Circuit Court. The decision reverses the generally accepted idea of nonpatentability of mechanical processes and establishes a rule for this class of patents. The various United States courts have been rendering conflicting opinions.

Still another bill for the creation of a bureau of mines has been introduced in Congress, this time by William F. Englebright, of Nevada City, Cal. The present bill provides for the making of inquiries and technologic investigations on the mining, extracting, and utilizing of the mineral substance of the United States, the treatment of ores, and the methods and conditions under which mines are operated, with a view toward the prevention of mine accidents, of the waste of material, to the betterment of mining conditions, and to the development of the various mining industries; and the investigation of materials of construction, fuels, and other mineral materials belonging to or for the use of the United States Government.

MEXICO.

Protection by Freight Rates.—New Mining Law.—Seguranza Mill.—Cyaniding at Zacatecas.

The new freight rate going into effect June 1 on foreign coal and coke entering Mexico, which amounts to an increase of from 75 cv. to ₱1.75 per ton, depending upon the port of entry and the length of haul, has given rise to considerable indignation among the coal producers of Texas, who will be most severely affected. They have had a committee in Mexico City investigating the subject, and as the new rating is applied almost wholly on the merged lines, which are controlled by the Mexican Government, the Texans think they can make it a case of Government discrimination against American products, and it is stated that they will endeavor to have the United States Congress introduce retaliatory clauses in the new tariff bill. The Mexican coal producers claim, however, that it is in no sense a Government discrimination against American coal and coke, as there are no duties against either, and that the new rates simply put the foreign product on the same freight basis as the home product. Whether the Texans will attempt to, or can, prove their case, remains to be seen.

The proposed new mining law which was left over from the last Congress has been discussed and disposed of by the Chamber of Deputies and has now passed on to the Senate. It is understood that endeavor will be made to rush it through so that it may go into effect July 1, 1909. The bill was thoroughly considered and discussed, article by article, in the lower house, and the greatest opposition was manifested against the arbitrary power given the Minister of Fomento (Secretary of the Interior) and his department, from whose decision there was to be no appeal. These articles were so changed that one may have access to the courts of the country when it appears that justice is not being obtained from the Department of Fomento. Thus individual rights are more closely protected.

In the Zacualpám district of the State of Mexico, the Seguranza 100-ton concentrating and cyaniding mill is nearing completion and would be ready to go into commission before the end of June were it not for the electric power-line, a branch of the Sultepec Electric Power Co. line, which will not be completed into Zacualpám before the end of July or the beginning of August. The starting of the Seguranza mill will immediately follow. The ₱25 per ton freight haul to the railroad has made this mill necessary, and it has been so constructed that the capacity may be increased by 50 or 100 tons as soon as the amount of custom work demands the increase. At present it is counting principally upon its own ores and those of the Olvidada mine, where a good body of 50-oz. silver ore is being blocked, pending the completion of the Seguranza plant. The old Concepción is again showing a large, rich body of silver ore, and at the Cuchara a 50-ton concentration mill is being built.

Zacatecas continues to figure on important improvements ahead. The new plant of 100 tons capacity—Chilean mills and cyanide equipment—at the Bote mine, is practically completed, and will at once begin treating the old dumps and mine fillings. Plans are also once more under consideration for treating with cyanide the enormous piles of old tailing on the patios at Guadalupe, below the city of Zacatecas. Examinations are being made of the Austuriana on the old Veta Grande with the view to resuming operations. At Fresnillo, the Fresnillo Mining Co., one of R. S. Towne's many enterprises, which for six years has been lixiviating with hyposulphite of soda some 2000 tons per month the old tailing dump, presumably from the Proano mines, is making alterations in the plant, whereby a much larger tonnage may be handled and cyanide introduced in place of hyposulphite. Other parties have been planning to quarry the Proano mountain at Fresnillo, which it is said will assay about 400 gm. (12 oz.) silver per ton, and cyanide everything as it comes, but there seems to be some hitch in carrying out these plans.



Zacatecas.

SALT LAKE, UTAH.

Copper Output.—Knight Mines & Smelter.—Jackling in Yerington.—Newhouse Holdings.

Copper producing mines of Utah have again reached the 10,000,000-lb. mark. During May the output of the red metal from the Bingham mines was maintained and the high mark set in April was again reached. Utah Copper has reached its maximum capacity of 5,000,000 lb. from its mill plants at Garfield and Copperton, the former with a capacity of 6000 tons and the latter of 1000 tons of crude ore daily. The Boston Consolidated again produced something over 1,500,000 lb., and other mines the usual tonnage. The Boston Consolidated will increase its production as soon as the last two sections of the mill at Garfield are commisisoned. Railroad facilities for transportation are satisfactory, and improvements in the 'ore-line' and additional equipment in engines and cars give assurance that there will be no further delays.

Jesse Knight has just issued a statement of the conditions at the Tintic smelting plant at Silver City. He says the company is operating four lead-furnaces, having a capacity of 225 tons each, and one copper-furnace of similar capacity. Until recently there has been a heavy expense in making alterations and additions to the smelter. Now it is making some profit. Within a few months, says Mr. Knight, the company will show a good profit on the original investment of about $1,000,000. Regarding the deal for the Tintic smelting plant, the Colorado, and the Iron Blossom mines, it is learned that the United States Smelting Co. and the International have each submitted bids. The American Smelting & Refining Co. has agreed to have a bid ready within a couple of weeks. The United States bid will not be considered, as it is too low. The Cole-Ryan bid is more satisfactory, and unless the American bid is higher it seems probable that the International will be the owner of the mines and smelting plant within 30 days. Good progress is

being made in the construction of the International smelting plant. Excavation for the foundation has been completed, and E. P. Mathewson, general manager, says that they will be prepared to receive both lead and copper ores by the first of the year. The advent of the International will give Utah operators four smelting plants, and will make this the largest smelting centre in the world.

Overtures have been made to D. C. Jackling to become interested in the copper mines in Yerington. The Blue Stone property, owned by J. R. De Lamar, and the Mason Valley, have been mentioned, but Mr. Jackling says that he has no time at present to consider these propositions. At one time he held a large block of Mason Valley, but disposed of his interests in this company several months ago, and re-invested his money in the Ray Consolidated, of which he is general manager. He is devoting his personal attention to directing the affairs of the Ray and Utah Copper companies, and while he will take some part in the reorganization of the Santa Rita Mining Co., to be known as the Chino Copper Co., he will not assume the personal management.

Samuel Newhouse is devoting most of his time to the direction of his personal holdings in Utah real estate. The Boston Consolidated's and Newhouse Mines & Smelters Co.'s operations are directed by executive committees chosen from among the directorate. The Newhouse holdings in each of the companies are not so large as formerly, though he claims that his confidence in the outcome of these mines is as strong as it has ever been.

KALGOORLIE, WESTERN AUSTRALIA.

Sons of Gwalia.—Ivanhoe. — March Output. — Australian Institute.

A few good developments have relieved a dull month. The Sons of Gwalia announced the cutting of the Sons of Gwalia South shoot in the west cross-cut, at level 14, the lode being 41 ft. wide and worth $12 per ton. This is a really fine development, and the Sons of Gwalia is our most important outside mine, as the Bellevue, Cosmopolitan, Great Fingall, and others which were noted producers, are only working on a small scale. The Sons of Gwalia ore is a schist cut by quartz. It is worked by means of a large incline shaft. Self-dumping skips tip the ore into jaw-crushers of the Blake type, the broken ore dropping into a small storage hopper, from which it is taken to the mill-bins by belt conveyor. Fifty stamps of 1100-lb. weight each crush the ore through a 20-mesh screen, and the coarse gold is caught on amalgamated copper plates. The pulp passes over 10 Wilfley tables, and is then elevated by a large tailing-wheel to the classifiers. The coarse sand from the first classifier runs to three 5-ft. grinding pans, passes over two Wilfley tables, and is again elevated by wheel. The pulp from the second classifiers then flows into eight steel collecting vats by means of the usual distributors. The sand is given a preliminary wash and is then dropped into a second set of vats for further treatment by cyanide, after which it is discharged. The slime overflow from classifiers and collecting vats is run into V-shaped settlers, and agitated, being finally treated in a Cassel plant of the usual design. The concentrate from the Wilfleys is dried somewhat, passed through an Edwards roaster, ground in a 5-ft. pan with KCN and Hg, run into small agitators, treated with KCN, and finally filter-pressed. The monthly output amounts to 13,389 tons yielding $100,000, of which $31,000 is profit.

At the 1970-ft. level in the Ivanhoe the cross-cut has gone through the east lode, it being 33 ft. wide and worth about $7 per ton. A fault has affected the orebody at this point, as in the upper levels; but driving usually reveals good ore beyond. The ore reserves are now published as 934,089 tons, averaging $11.75 per ton. The No. 3 lode in the Golden Horseshoe was cut at the 2000-ft. level, the width being 7 ft. and value $15 per ton. The reserves amount to 1,065,409 tons worth $12 per ton. Driving north from Hamilton shaft in the Great Boulder, at 1500 ft., the Ivanhoe east lode has a value of $15 over 4½ ft. width. The ore reserves in the Great Boulder total 731,426 tons worth $16 per ton. The new vertical hoist, head-gear, breaker station, and conveying system are in full working order. The Lake View Consols reserves are stated to be 174,189 tons at $6.60 per ton; the Associated, 483,517 tons worth $10 per ton. The Associated has now got its large surface condenser at work, also a new Bellis-Morcan generating set for power and lighting. Five A. Z. agitators now deal with all the mill pulp. The Kalgurli company is now sinking below 1600 ft. Fair results are being met with below 2000 ft. in the Great Boulder main reef. The North Kalgurli is erecting another 10 stamps, making 20 in all. This property is worked mainly by tributors, but it has been lately re-sampled with a view to the company working it. The Lancefield, some 200 miles north of this centre, is at work again. It appears that graphite is the great trouble in treatment up there, and not so much the arsenic, of which he heard so much. The March gold output from the State was valued at $2,700,000, and for the year to date $8,000,000. The returns from the principal producers in March are as follows:

Name.	Tonnage.	Value.	Profit.	Dividend.
Associated	11,718	$115,000	$35,000	.....
Associated Northern Blk.	3,750	33,000	14,000	.....
Golden Horseshoe	25,103	255,000	100,000	.....
Golden Link	4,066	33,000	*1,500	.....
Golden Ridge	2,280	28,000	14,000	$31 000
Gt. Boulder Proprietary	16,259	247,000	130,000	325,000
Gt. Boulder Perseverance	18,725	140,000	31,000	.....
Great Fingall	14,268	70,000	400	.....
Hainault	5,010	30,000	2,500	.....
Ivanhoe	19,307	215,000	105,000	.....
Kalgurli	10,900	142,000	80,000	.....
Kalgurli South	9,039	61,000	13,000	.....
Lake View Consols	7,367	60,000	14,000	.....
Oroya-Brownhill	11,580	100,000	37,000	.....
Oroya-Black Range	4,718	59,000	22,000	.....
Sons of Gwalia	13,389	100,000	31,000	60,000
Sons of Gwalia South	2,050	26,000	7,500	.....

*Loss.

At the end of April, the Australasian Institute of Mining Engineers met here. It is about eight years since they met here last, and that meeting was characterized by some lively discussions on treatment, as the present processes were not perfected at that time.

TORONTO, CANADA.

Cobalt.—Elk Lake.—Gowganda.—Alberta Petroleum.

An important strike was made at the Beaver mine, in Cobalt, May 14. A vein 10 in. wide, assaying some 4000 oz. silver per ton, was discovered in an adit 50 ft. east of the main shaft at the 200-ft. level. The significance of this find lies in the circumstance that extensive development on the upper levels led to no discoveries of value, leading to the conclusion that deep mining is necessary to realize the possibilities of the camp. The strike had an immediate effect on the stock-market, the shares which had been selling for about 18c. suddenly doubling in price. Good ore is being taken out, and the Beaver will shortly figure in the shipping list. A massive nugget has been found a short distance below the surface on the Cobalt Gem property, in which Philadelphia capitalists are largely interested. It weighs approximately a ton, being 5 ft. 6 in. long, 2 ft. 5 in. wide, and 16 in. thick, and is 75% silver. It will be sent on to Philadelphia. Systematic surface prospecting on the location has been begun. The La Rose is extending its workings by cross-cutting under the track of the Temiskaming & North Ontario railway to reach its holdings on the town side of the railway hitherto undeveloped. The ground will be worked from the first level of the La Rose. The new vein of the Lawson property, now owned by this company, has been stripped for 28 ft. and yields high-grade ore, carrying much native silver. A strike has been made on the Paymaster 120 ft. from the shaft at the 100-ft. level, where a small stringer has developed into a 2½-in. vein of solid cobalt carrying silver. At the Otisse-Currie in the Montreal River district, another shaft is being sunk. At a depth of

6 ft. the vein shows about 7 in. wide and carries cobalt, galena, and silver. The main shaft is down 71 ft., the vein maintaining its quality.

Elk lake is now accessible, navigation having opened. The first boat from Latchford arrived on May 19. Since then regular trips are being made twice a day. In Smythe township several promising properties have been opened up in the diabase belt. Among the best is the Watts. A stringer, after being followed down 23 ft., has widened to a vein of 3 to 4 in. with high silver content. The Langham and the Gavin Hamilton in James township, both equipped with compressor plants, promise to become shippers shortly.

Gowganda is still cut off from the outside world, and most of the mines are out of communication with the town, so that authentic news is difficult to obtain. From all accounts little actual mining has so far been done. A quantity of ore has been sacked at the Boyd-Gordon, and ore is also being taken out at the Bartlett, Reeve-Dobie, Silvers Limited, and some others. But it is likely that it will be necessary to store the output until the winter roads are available for transportation, making perhaps a few sample shipments of high-grade ore by freight canoes or wagons at enormously high rates. A large influx of prospectors and mining men is anticipated as soon as the region becomes more accessible. The almost prohibitive price of lumber is felt as a serious drawback to the camp. Owing to the high price of labor and excessive stumpage dues charged by the Government, rough lumber costs $70 per thousand feet, and dressed lumber from $80 to $90 per thousand, so that tents and log-houses take the place of frame buildings.

Eugene Coste, of this city, has for some time been making an inspection of the petroleum and natural gas field at Bassano, Alberta, 83 miles east of Calgary, for the Canadian Pacific railway, and has reported that in all probability natural gas exists there in large quantities. His opinion is that a series of gas pockets follow the same strata as those from which the supply of Medicine Hat is drawn. The company has accordingly commenced boring operations in the hope of securing gas in sufficient quantity to supply Calgary. D. D. Cairns, of the Canadian Geological Survey, and party has left to investigate the copper, silver, and gold deposits of the Watson and Wheaton districts, Yukon Territory.

BRITISH COLUMBIA.

Dominion Copper.—Granby.—Geological Survey. — Nugget. — Consolidated.—Mining Institute Meeting.—Le Roi.—Production for 1908.

At the sale of the property of the Dominion Copper Co. only $150,000 was bid for the several mines, smelter at Boundary Falls, and most of the supplies, while but $5000 was bid for the supplies designated as lot B. The only bidder was M. Weinman, representing the re-organization committee of the bondholders. The sale was postponed until June 3, when it is expected there will be other bidders. The sum of $155,000 will not go far toward reimbursing the bondholders their $800,000, and other creditors the further sum of nearly $100,000. Ore shipments from the Granby Consolidated mines showed a small increase during the week ending May 28, and this will very likely continue during the ensuing week, as two more of the enlarged furnaces have been blown in, and the work of enlarging No. 5 and 6 has been started. It was expected that this work would have been completed in July, but the smelter has been kept so busy that it will be some time in October before the eight furnaces have been altered. The new furnaces are giving good results, and what was partly an experiment has proved a big success. The Granby Co. put in an 8 by 12-ft. triple pump last week, placing it on the 400-ft. level, from which point it will be used to pump water to a tank 500 ft. up the hill. The Geological Survey of Canada expects to do more work this year in British Columbia than ever before. Extensive mapping will be done in the Tulameen district. O. E. LeRoy and assistants have just completed detailed work in Phoenix and have left to take up work in the Slocan. Mr. LeRoy is also working on a geological map of Sheep Creek district. A survey of the West Fork of Kettle river will be started this summer. Texada island, Vancouver island, the Skeena River section near Hazelton, southwestern Yukon, and the Fort George region, as well as the coal areas near Telkwa, will all receive attention this summer, parties having already departed for the various districts named. The identity of the capitalists for whom M. K. Rodgers has bonded the famous Nickel Plate mines at Hedley has not as yet been revealed. The property has been thoroughly sampled. Two years ago the Nickel Plate concentrate had to be hauled 50 miles to the railway; in a short time this product can be loaded on the cars at the mill door and shipped over the Vancouver, Victoria & Eastern Railway (Great Northern).

A new small vein was cut in the tunnel now being driven on the Nugget, near Nelson, last week. The strike occurred about 70 ft. from the portal of the adit. The Nugget mill is turning out a gold brick every two weeks valued at from $4000 to $5000. Last week the Consolidated company acquired the Alice mine at Creston, 60 miles west of its St. Eugene property, at Moyie. The Alice is a silver-lead mine of promise. There is a 60-ton concentrator on the ground. The Consolidated Mining & Smelting Co. of Canada; Granby Con. Mining, Smelting & Power Co.; British Columbia Copper Co.; Le Roi No. 2, Ltd., and Le Roi mining companies, all recognize that the life of a mine is short. The first three of these concerns are investing in mines and have up-to-date smelting, converting, and refining plants in operation, while the other two are emulating their example as far as their means will allow. A meeting of the Canadian Mining Institute was held at Coleman, Alberta, on May 26, at which the usual routine business was carried through and papers read on rescue apparatus for coal mines, progressive mining, and other subjects. The silver-lead mines of the Nelson district have just received from G. O. Buchanan, Kaslo, checks from the Dominion Government for the bounty on the lead content of their ores to March 31. The McGillivray Coal & Coke Co., Coleman, Alberta, has decided to build 10,000 ft. of electric road from its mine on McGillivray creek to the Canadian Pacific railway main line. A steam-power plant will also be put in shortly. Byron E. Sharpe, Spokane, Wash., is secretary.

The Le Roi No. 2, Ltd., has planned to expend about $18,000 in deepening the Josie shaft from the 900 to the 1200-ft. level. One of the rich Le Roi lodes extends into the Annie claim of the Le Roi No. 2 at about this depth, and as the ground has been partly proved with diamond-drills, it is expected good results will be obtained from this work. Another copper furnace has been blown in at the Trail smelter of the Consolidated company. This is one of the largest copper furnaces in Canada, and is the fourth put in operation at Trail. Mechanical feed is being installed at the big lead furnace at Trail. It is said by the management that this lead furnace smelts more ore daily than any other lead stack on the continent. It has made as high as 98 tons of lead bullion in 24 hours. As we pointed out at the end of 1908, there was a small increase in the metallic production of this district, while the coal-mining industry just about held its own. A preliminary report on the mineral production of Canada in 1908 shows that there was an increase of about half a million dollars. The output was valued at something over $87,000,000, as against a figure under that amount for 1907. But for the slump in metals the value of the output would have been $8,000,000 more than it was. Silver showed an increase of over 72% (the lead bounty may account for part of this); gold and copper also showed increases. Iron, lead, and nickel showed a slight decrease. It has been nine years since gold showed an increase. The Yukon output increased as well as that of British Columbia, most of the precious metal in the latter case being mined by the Rossland-Trail Creek mines. The placer gold output was 44% of the total, quartz mining being credited with 56%. The copper output was 64,361,636 lb., an increase of 14% over 1907. The British Columbia increase was over 7,000,000 lb., of which a large part was mined in the Boundary district. All of the $1,920,487 lead output was mined in British Columbia. The coal production in British Columbia was $7,280,000, against $7,390,306 in 1907, being 2,329,600 tons and 2,364,898 tons, respectively.

GOLDFIELD, NEVADA.

Florence Goldfield Dividend.—Consolidated Shipments.—Combination Fraction Development.—Grand Jury Indictments.

Announcement is made that the Florence Goldfield Co. will pay a dividend on June 15 amounting to 10c. per share, a total distribution of $105,000. This will be the fifth dividend of the company, the former payments, made last year, being entirely from money received as royalties from lessees. The work of enlarging the Florence mill is now going forward rapidly. Grading is in progress at the south side of the plant, where the walls of the structure are to be moved a distance of 40 ft. to accommodate the additional machinery, which will consist of a tube-mill, plates, and several Card concentrating tables. In addition to this new equipment the company has secured a high-power pump for the main shaft and an air-compressor for the cyanide department. The grade of ore being treated is maintained at about $25 per ton, the product being taken from the company workings above the 350-ft. level and from lease dumps. The raise to connect with the main shaft from the 500-ft. level of the Engineers' workings has still nearly 100 ft. to go to complete the connection.

The Consolidated company is shipping bullion at the rate of one bar daily, the output for 36 days past being valued at $597,350. For the month of May the bullion shipments were $511,050. From 12,305 tons of ore mined during May the estimated gross extraction was $767,000, the total cost of production $145,000, and the net profit to the company $622,000. Shipments of high-grade ore from the Hampton stope have been less than formerly, and every effort is being made to treat as much of the product as possible while keeping the mill heads at the desired figure of $35 per ton. The ore shipped has averaged $800 per ton, though some has exceeded that value. No high-grade ore has been hoisted during the past week, and that which is broken in further opening the Hampton stope is stored in the workings. An increased production is being made from the Mohawk mine, while 150 tons daily are being taken from the new stopes of the 260-ft. south drift on the Red Top and Lucky Boy. Both mills of the company are treating nearly their full capacity of ore daily, and the new mill has at times exceeded its rating of 600 tons daily.

A regular production of 85 tons per diem is maintained by the Combination Fraction mine, the product coming chiefly from stopes above the 450 and 200-ft. levels, while at several points between good orebodies are being developed. The long cross-cut at the 600-ft. level is being driven toward the Hampton stope vein of the Combination. The Little Florence lease on the southern portion of the Fraction has been declared forfeited, and the parent company has taken possession of the workings. The leasing company has been unable to perform the work required by the terms of the lease, and since the first of the year has been operating with funds subscribed by the directors. The Daisy mine is making a profit from the output of 10 tons of ore daily, and is developing on an extensive scale at four levels, employing over 50 miners. At the 500-ft. level the main lead has been cut, and a drift is being driven toward the ore-shoot from which production is being made at the upper levels.

The Esmeralda county grand jury on June 4 returned indictments against the officials of the Pittsburg Silver Peak and the Florence Goldfield M. Co., the former at Blair and the latter at Goldfield, on the charge of conspiracy in attempting to defraud the State of Nevada of its bullion tax. The officers of the Pittsburg Silver Peak are William Flynn, president; George T. Oliver, vice-president; T. J. Crump, secretary and treasurer; John S. Weller, general counsel, all of Pittsburg, Pa.; Edmund Juessen, consulting engineer, and George O. Bradley, manager, Blair, Nev. The directors are Ralph E. Flynn and J. G. Splane, both of Pittsburg, Pa.; Charles Y. Fuller and M. A. Carton, of Utica, N. Y.; Frank Knox, Salt Lake; and J. H. Brown, Wilmington, Del. George T. Oliver is the newly elected Senator from Pennsylvania. He has denied any personal knowledge of the facts, and states that he had only incidentally learned that there was some matter of taxation in dispute between the company and the State, and he was personally satisfied that no illegal acts had been committed as charged. The company's annual statement to the stockholders shows a large profit from last year's operations, while its statement to the bullion tax collector shows no net profits. Charges against the profits of $4 per ton for milling are made, whereas the books of the company show the cost of milling to be only $1.10 per ton, it is claimed. It is stated by the district attorney's office that the directors and officers of the company were cognizant of the false charge against the profits, and sanctioned it, and therefore are guilty of conspiracy. A report made to the stockholders on February 17 shows a net earning for the preceding fiscal year of $348,482.

The officers of the Florence Goldfield Mining Co. are: Thomas Lockhart, president; A. D. Parker, vice-president and treasurer; A. M. Lockhart, wife of the president, secretary; and E. B. Parker, wife of the vice-president, and E. S. Vandyck, directors. Mr. Parker is vice-president and general manager of the Colorado Southern at Denver, and Lockhart is one of the best known mining men in the State. The Florence is a highly profitable mine, the output from its mill being $55,000 per month. It is stated that the Florence has charged against its profits losses made by unproductive leases operated by others on the Florence ground, while the company collected royalties in large amounts from the productive leases, but did not include the amounts in their bullion tax returns.

BUTTE, MONTANA.

Colorado. — Low Rates on Silver Ores. — Raven Re-organization.—Great Falls Smelter.—Tredinnick Process.

The Davis-Daly company has started sinking in the Colorado shaft. The shaft is now down 1480 ft., and it is the intention of the management to continue the sinking as rapidly as possible until 2000 ft. is reached. This will take about six months, and by that time it is expected that the available ore supply will be such as to justify the re-opening of the big concentrator at Basin, formerly operated by Heinze.

The low freight tariff on silver ores which the Chicago, Milwaukee & Puget Sound railroad has agreed to put into effect from Fergus county to Anaconda, with a lower treatment rate granted by the Washoe smelter, will enable $12 ore to be handled at a profit. The re-organization of the Raven Mining company is now taking place. There are at present 630,000 shares of stock outstanding. Stockholders will be asked to subscribe, share for share, to stock in a new company, which is to have an authorized capital of 1,250,000 shares, par value $1 each, by the payment of 25c. per share, payable in installments of 15 and 10c. The officers of the Butte & Ely Copper Mining Co. have ordered resumption of work on their properties at Ely, Nevada. Development was suspended two years ago. Ore had then been found in three shafts. It is now proposed to test other holdings by churn-drilling. That the Boston & Montana smelter at Great Falls is to be enlarged and improved has been stated by C. W. Goodale, the superintendent, following a visit to the plant by Benjamin B. Thayer and John Gillie.

Adolph Wetzstein, of Butte, and Stephen Tredinnick, formerly of Butte but now of Omaha, have invented and patented a process for desilverizing lead bullion, which is now being installed in the Omaha plant of the A. S. & R. Co. Argentiferous lead ores are usually low in silver, and the cost of refining by the ordinary processes is stationary. By the Tredinnick process the cost is on a graded scale proportional to the amount of silver carried. Missouri lead containing only half an ounce of silver per ton may be desilverized at a cost of only 15c. per ton, according to L. S. Austin. Thus the cost of concentrating and desilverizing the several grades of lead bullion would vary from 15 to 64c. per ton. To this must be added the cost of treating the drosses, the first melting, and final molding of the market lead, which will run about 25c. per ton. An improvement on the process is now being made which will permit two or more crystallizations on the same charge and kettle. The extra crystallizations will eliminate the bismuth, or render it below the limit.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Mining claims in any number may be located by a single individual, or by any association of persons. The only limitation is the greed of the locator.

Bismuth extraction from ores by a hot alkaline solution was patented by Stanley C. C. Currie, May 16, 1904, U. S. patent No. 881,101. We do not know whether the process has been applied industrially or not.

Location notices should be complete enough in description to clearly define the ground claimed, so that it might thereby be identified by others. The notice posted on the ground, and the one recorded with the county or district recorder should be exactly alike.

Ore 'frozen' to the wall in a granite country, in itself has no significance. The meagre data submitted allows no important deductions to be made, but the circumstances suggest the possibility that the so-called orebody is in effect a highly acid (silicious) pegmatite dike, or it may be a vein resulting from segregation of silica.

Kaolin, washed and ready for market, is worth from $8 to $9 per ton in New York. A royalty of 50c. per ton gross on the mineral in North Carolina would be excellent compensation. The costs of mining, preparation, and shipment will leave only a reasonable profit for the operator after paying such a royalty, even when the kaolin is of high grade.

Custom waives close adherence to the letter of the law in the matter of including among the 'locators' of a mining claim those not actually on the ground. Nevertheless the law concedes possessory title to discoverers, and in consideration of such discovery. In strict construction of the law those who did not share in the discovery could not make good their claims to an interest in a partnership location.

Estimation of lime by the sugar method consists in determining the hydrate or available CaO_2H_2, taking advantage of the solubility of that substance in a solution of sugar. The carbonate is insoluble in sugar. The lime is agitated with sugar-solution, and filtered, after which the lime is estimated by the ordinary alkalimetric method. Forty parts of sugar in 100 parts of water will hold in solution 11½ parts of CaO.

Criadero is the name given to a mineral deposit in Spanish. It means literally the place where a thing is created. The character of the deposit is stated by modification of this word, as 'criadero en veta', a vein deposit; 'criadero detrítico', an alluvial or placer deposit; 'criadero en filón', a vein of considerable longitudinal extent; 'criadero bolsado', an irregular mass; 'criadero en manto', a bedded deposit; and 'criadero en riñones', lenticular (kidney-shaped) orebodies.

Mercuric chloride (corrosive sublimate) reacts promptly with copper, forming copper chloride, and depositing mercury, which amalgamates with the copper. This is a good method for re-amalgamating bare spots on plates in gold mills. The surface treated must be well washed first with a solution of lye, and that in turn thoroughly washed out; after which silver amalgam may be rubbed in. A surface so prepared should start catching gold as readily as on old, 'well soaked', electroplated copper plate.

Gold, even when coarse, is reduced to a fine state, exceedingly favorable for cyanidation, by tube-mill grinding. Although modern practice inclines to cyanidation, it must be borne in mind that in some gold ores cyanicides are present which cause a consumption of cyanide which often becomes economically prohibitory. Amalgamation is often effected more readily after tube-milling than after simple stamp-milling of the ore. In cases where cyanide consumption is excessive it would be well to test the possible extraction by plate amalgamation after tube-mill grinding.

Partnership claims are generally located jointly, that is, the discoverers all sign their names to the location notice. This should, however, be done only when they actually are joint discoverers; otherwise the actual discoverers should make the location, and then include other partners by an assignment of their due interest. In mining parlance, one partner will 'locate in' the others, merely to avoid the routine of making the assignment, and the cost and inconvenience of having it acknowledged before a notary. Such an assignment also must be recorded, adding more rigmarole and cost.

Abandonment of a group of claims has no influence on present rights under re-location, if there be no adverse claimants. The question propounded reduces to that of validity of assessment work done on one claim only, to cover the entire group. If the development is manifestly for the benefit of the entire group, the work so concentrated at one point will apply; for example, if the group covers a vein which extends continuously through the several claims, a shaft on one might benefit all, on the assumption that levels would be driven at different depths, developing the vein in its total extent.

The Hoepfner zinc process adopted by Brunner, Mond & Co. consists in roasting the ore and leaching the metal out as a sulphite with SO_2 solution. This is oxidized by aeration, and the zinc sulphate converted into chloride by salt (NaCl). The electrolyte is a solution of zinc and other chlorides; the cells are divided into anode and cathode compartments by diaphragms. The cathodes are rotating discs of zinc, only partly immersed in the electrolyte; the anodes are carbon or lead. Mond substituted revolving rolls for the discs. The zinc sulphate solution may be chloridized by mixing with the waste calcium chloride, liquors from the ammonia-soda process. Calcium carbonate ('pearl-hardening') in a form desired by paper makers is thrown down as a by-product, and chlorine gas is liberated at the anodes, available for making bleaching powder. The zinc obtained by this process is particularly pure, and is valuable for making brass for cartridge cases.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Designing Mine Equipment.

The Editor:

Sir—Under the above heading, in your issue of May 8, is an article from P. Schreiber, of the Arthur Koppel Co. Mr. Schreiber's main point is, that manufacturers of mining equipment should do the designing and make alterations to suit various conditions. I agree with him perfectly upon this point; furthermore, it has become a thing of the past for the chief engineer of a mine to undertake the design of something that is standard among manufacturers. I wish to discuss the question of designing in a little broader sense than Mr. Schreiber has done, that is, how to get the best equipment for the least money.

In the building of a surface plant, a mill, a smelter, or whatever the conditions require, there are two kinds of equipment. One is the standard article, made by the manufacturer, the other is the special thing that connects the various standard machines. For example, an engine is standard, a blower is standard, but the air-pipe that connects them, is special. It is the business of a chief engineer who represents his company economically to know a good article of manufacture when he sees it, to know how to arrange it for the work it has to do, and above all to know how to design in detail anything that is special. If the special design pertains to a machine itself, the manufacturer certainly should be consulted. The chief engineer who knows it all has probably only been out of school a short time. As he grows older he will know less, and will be paid more for what he does know. Again, this special thing which is designed by the chief engineer, is made up of a number of standards. The pipes have standard flanges and valves. The steel plates and angles used are standard, in so far as stock sizes and quantities are concerned. The advantage in having the chief engineer at the plant design in detail, is the saving in time and the competition in prices. An entire equipment can be installed and in operation in the time consumed by the various manufacturers in finding out what is wanted. The chief engineer shows his wisdom in allowing manufacturers to make changes and suggestions that will cheapen the cost but not alter the value.

How can the chief engineer reduce the first cost? Suppose the mine is at a considerable distance from the manufacturers. The mining company wishes to get competitive prices. Are each of the manufacturers to send a representative to the mine, find out what is wanted, and then submit prices? Are the manufacturers going to do this consulting work for nothing? Most makers of mining equipment maintain a designing department. It is next to impossible to do business any other way. These designers have their troubles, the chief one being the impossibility of getting engineering information from the field. It is not a designer's business to create information; it is his business to create the proper equipment after he knows the conditions in the field. Here is where the chief engineer is a saving to the mining company. He can express in engineering language exactly what is wanted. He can give all the outline dimensions that the shop designer needs to complete a proposal. The manufacturer quotes the lowest price from the start, because he knows exactly what is wanted. The mining company can install a variety of machines, selecting what is considered best for the purpose; the chief engineer's business being to see that all special connections are provided for. Mr. Schreiber cites an instance where manufacturers can save in the use of standard patterns. I will cite another instance that came under my own supervision. A certain mining company attempted to build a surface plant from a manufacturer's drawings. The first thing I discovered upon arrival in the field was, there were three different gauges of tracks. The manufacturer's representatives who supplied the cars admitted to me that he called for the different gauges because he had standard patterns for the cars, which he did not want to alter. On the whole, I think that each engineer has his field of usefulness. A company that attempts to build from manufacturers' drawings makes a mistake. A chief engineer who is bigoted may prove an expense to the mining company. The broad-minded chief engineer, who has studied the standards of manufacture, who knows how to specify what is wanted, and who knows how to design the special thing, will prove a valuable adjunct to any mine.

MAX J. WELCH.

Los Angeles, May 24.

Valuation of Mining Stocks.

The Editor:

Sir—From time to time articles and discussions have appeared in your valuable columns regarding mining stocks, with the evident purpose of finding some method of arriving at the value of mining shares, in order to safeguard investors against loss. The writer feels that in all these discussions it is beyond the mining engineer or critic to safely give advice. It cannot be disputed that every investment in mining prospects is bottomed upon no safe premise or conclusion, but is made rather in the fond hope that such investment may prove to be one of those rare ones where fabulous returns will follow. There is no possible means to judge the value of a mining prospect. You accept it by faith or you do not accept it at all. This deduction is based on the assumption that titles are good, capitalization ample, division of promotion or property interest on one hand and of treasury allotment on the other, reasonable; the management experienced, honest, intelligent, and energetic. The remaining questions relate to the method of raising the needed funds and to the price of stock offered. When stock of a mining company is offered for subscription at, say, 10c. to 25c. per share for the treasury issue, no reasonable purchaser should conclude that the company pretends that the value of the mine warrants it, or that the stock is at that time worth the sum asked. It simply

means that the needs of the mine require certain sums of money for development and equipment. It means that the first offering, in the wholly unproven state of the property, at say 10c., and a second block later at 25, and perhaps a third offering at 50c. per share, will raise the funds required, and that when these sums of money are intelligently and honestly applied, the management hopes (I say hopes) that the mine will be worth a sum of money based upon the highest price paid, multiplied by the total outstanding shares. The trend of argument has heretofore seemed to make it appear that the company or its agent represents the stock to be worth the price asked. By no means is this true in the case of a prospect. You cannot apply stock exchange argument and stock exchange rules in such a case. The whole enterprise at first is a simple venture based largely on faith. Who would maintain that the first 100 shares of a newly organized oil company which realized for development purposes but $10, made the then outstanding issue of, say, 500,100 shares of the total 1,000,000 capitalization worth a total of $50,010? That $10 is their total moving, active, working capital. Suppose no more can be sold. With no derricks erected, no wells bored, and only a location near to some proved oil-field, neither the enterprise nor the stock can have any definite or fixed value. The first block of stock sold is not, in expectancy, as desirable as the second placed, and none of them equals in expectancy the final block placed, for without the final sum the enterprise fails entirely. This is why a board of directors fixes in advance the price at which their different blocks of stock shall be sold. A mining or an oil proposition in the early development stage can have no determined, proved value. It is a matter almost wholly of expectation, and with the same given facts expectation of future development varies with the temperament of each investor. One may say, 'I believe the returns will be 1000%', another, '10% profit yearly', and so on. If there were no promotion stock, if each one bought his stock alike, it would be wholly immaterial whether they paid 10c. or $1 per share. The less they paid per share, the more shares there would be outstanding to participate; the more they paid, the less to participate. Whatever they paid, if a uniform sum, is in the nature of a voluntary level assessment, the stock in such a case being taken merely to fix their relative interests in expected profits. Let us get away from all this talk about stock in speculative ventures, like prospects and oil exploitation being worth the price asked by the company for its treasury offering. Custom has made it fashionable to incorporate companies high and sell their stock low, simply to conform to a general weakness in human nature which demands higher quotations. All this is founded on fallacy. It is impossible to keep any quotation stable, even in a fully developed producing property. As a prospect has no production, the owner can draw on no showing in fixing an asking price, so he bases the offering wholly on the needs of the property, and the investor should judge it from its expectation and promise. The stock exchange rule cannot apply to a mine while it is young. Its value is almost wholly problematic, and no two people would arrive at the same conclusion. There is a distinct line of difference between a going enterprise and one in the process of development. The value of the first, and its stock, can be somewhat accurately determined, but no human wisdom can fix in advance that of the second. Buy stock in a developed enterprise and pay for it on its showing. In an undeveloped enterprise, get at the facts, then figure out, in your own way, its reasonable expectation, make your investment or leave it—and win or lose like a man.

J. L. Makeever.

New York, May 15.

Sintering at Cerro de Pasco.

The Editor:

Sir—The sintering plant at La Fundición, Peru, is of the down-draft type, designed by Frank Klepetko. Shallow pans, with bottoms of steel grate-bars, were first covered with a layer of limestone. Ore was spread on top of the limestone. Hot coals were thrown on the ore, an adjustable hood fitted to the pan, and the air-blast turned on. Sintering here has proved a failure. About three-fourths of the sulphur in the ore was expelled and only about half the fine ore agglomerated. We were thus obtaining a rather inferior product for the blast-furnaces, and losing a large proportion of our available fuel (sulphur). At the same time our labor and coal-costs were high. The treatment of the fine ore in reverberatory furnaces has proved far more economical and satisfactory at the plant. Consequently, the sintering plant has been abandoned. The sintering of fine ore was suspended here shortly after my arrival at La Fundición.

H. W. Ross.

La Fundición, Peru, May 6.

Crucible Assays.

The Editor:

Sir—When first obliged to teach a beginning class assaying, the writer was impressed by the vague and unscientific discussions of crucible charges as given in the older text-books. Most of them merely give tables of charges for various pure gangues, and it is difficult from these to flux complex mixtures of minerals. A method of calculating crucible charges was therefore worked out, so as to eliminate all uncertainties except the exact percentage composition of the gangue. Professor Fulton's* recent book has a good discussion of the nature of assay slag, but it gives no simple method of calculating charges. It may be of interest, therefore, to present the following directions for crucible assaying, which are given to the students of the University of Arkansas after they have determined a few slags by metallurgical methods: (1) Examine the material submitted for assay and estimate its approximate mineralogical composition. Then write down the corresponding weight of each mineral in the quantity to be melted (usually 0.5 A.T., called 15 gm.). (2) Silica. Add, if necessary, enough silica to make, with that already present in the ore, 2 gm. SiO_2 for each gram of

*'A Manual of Fire Assaying', by Charles H. Fulton.

$CaCO_3$, $MgCO_3$, or $BaSO_4$ present, and 1½ gm. for each gram of Fe_2O_3, ZnO, clay, or other infusible silicate present. Limonite is equivalent to seven-eighths of its weight, Fe_2O_3 and pyrite to two-thirds. Consider 1¼ gm. of powdered glass equivalent to one gram of silica. (3) Borax. Add ⅓ gm. of borax glass for each gram of silica or infusible silicate (clay or talc) present in the ore and the fluxes. For cupel assays add 4 gm. of borax for each gram of bone ash. (4) Soda. Add 1⅓ gm. of sodium bicarbonate for each gram of SiO_2 present in the ore or fluxes. Consider fusible silicates, as glass, etc., equivalent to 50% silica. For pure lead ores add at least two-thirds the weight of the ore. For clay, talc, etc., use a mixture of soda and potash. (5) Litharge. Add enough litharge (0.20 gm.) to make, with the lead already in the ore, an 18-gm. button, and in addition for the slag 2 gm. of PbO for each gram of silica or infusible silicate in the ore. (Consider glass as equivalent to 50% silica.) For cupels add 2 gm. of PbO for each gram of bone ash. Increase the amount of PbO largely to keep copper, zinc, antimony, arsenic, and tellurium out of the button if they are present in the ore. For ease in correction for silver in the PbO, use litharge in even multiples of 10 gm. only. (6) Argol or nitre. Add enough argol or nitre to make an 18-gm. button. One gram of Fe_2O_3 may be assumed to prevent the reduction of about 1½ gm. of lead, but the reducing power of sulphide should be determined by a preliminary assay, if present. When more nitre than the weight of the ore is required, do not use this method. Roast ores containing much pyrite, antimony, or arsenic, adding charcoal for antimony and arsenic. If but little nitre is required, use the nitre method in preference to roasting. For galena, etc., nails may be used with charges in which the PbO for the slag is replaced by $NaHCO_3$ in excess. When nitre is added in the nail method, be careful to form no FeO, which will not fuse in the soda slag. (7) Buttons brittle from antimony or zinc, or showing scales of copper, must be scorified.

This system of fluxing forms a bi-silicate of Na_2O and PbO, or $NaPb(SiO_3)_2$. This is ample flux for a pure quartz gangue, and in it the other bases dissolve, forming, of course, slags of lower silicates. As given, the charge for pure limestone will yield a slag of an oxygen ratio of 1 in base to 1.54 in acid, not counting the borax. $BaSO_4$ gives a ratio of 1 to 1.7; $MgCO_3$, 1 to 1.47; Fe_2O_3 (as FeO), 1 to 1.33; clay, 1 to 1.42. Since borax is added to form a boro-silicate, it is reasonable to figure it according to the amount of SiO_2 present in the slag. The proportion given has not been finally settled upon as best. It is sufficient to greatly lower the temperature of the slag-formation to make the slag viscous during the reduction period and to lower the temperature of the final complete fluidity. It is also sufficient as a general safeguard to flux a slight excess of either acid or base. On the other hand, it is expensive, and makes the buttons more difficult to clean.

Our charges are a little higher in PbO than usual, and for some basic ores it will be more economical to substitute soda for litharge, but this makes the charge more bulky. For ease in remembering, it was thought better to have a constant ratio of soda and litharge to silica, rather than to use the form 1 to 1½ gm. soda, 1½ to 2 gm. PbO, for each gram of silica. This is more nearly what would be used by an experienced assayer.

The amount of flux as given by this table is ample. In estimating weights to be fluxed, even grams are taken, using care to see that the weight of refractory mineral is over rather than under-estimated. The minimum amount of the sodium-lead-silicate required to dissolve the various bases has not yet been accurately determined. This should be worked out for the more common minerals by making up charges of the pure oxide. It is also desirable to work out the amount of excess litharge needed for each gram of copper, antimony, etc., in the charge to make clean buttons. This PbO method has been found to work well with as much as 25% antimony and 60% zinc, but it is not so successful for copper. A large excess of PbO severely attacks the crucibles, and the risk of ruining the muffle-button by spilled charges becomes important. Therefore it is thought best to scorify the copper buttons as is done with the buttons obtained in the standard scorification method for copper mattes.

On account of this dissolving action of litharge upon the crucibles, more litharge than that given in the directions is of advantage in assaying clay and talc ores. The charges without excess of litharge have very little effect upon Denver crucibles, and they attack Battersea crucibles but slightly. The borax seems to protect the crucibles from being 'drilled' by PbO, probably by coating them with a viscous aluminum boro-silicate.

I have found that by long fusion cupels can be entirely dissolved to a fairly fluid slag by much borax with some PbO and no soda or silica. This forms calcium borate and sodium phosphate, as in the tests on platinum wire. The amount of bone ash in the charge is determined by weighing the cupel with the litharge and subtracting the standard weight of that size cupel when new in order to give the PbO to be deducted from the weight of the stained part of the cupel. Apology is offered for the incomplete state of these data, but I hope that the chemistry department can again take up instruction in assaying and continue the investigations begun.

A. A. Steel.

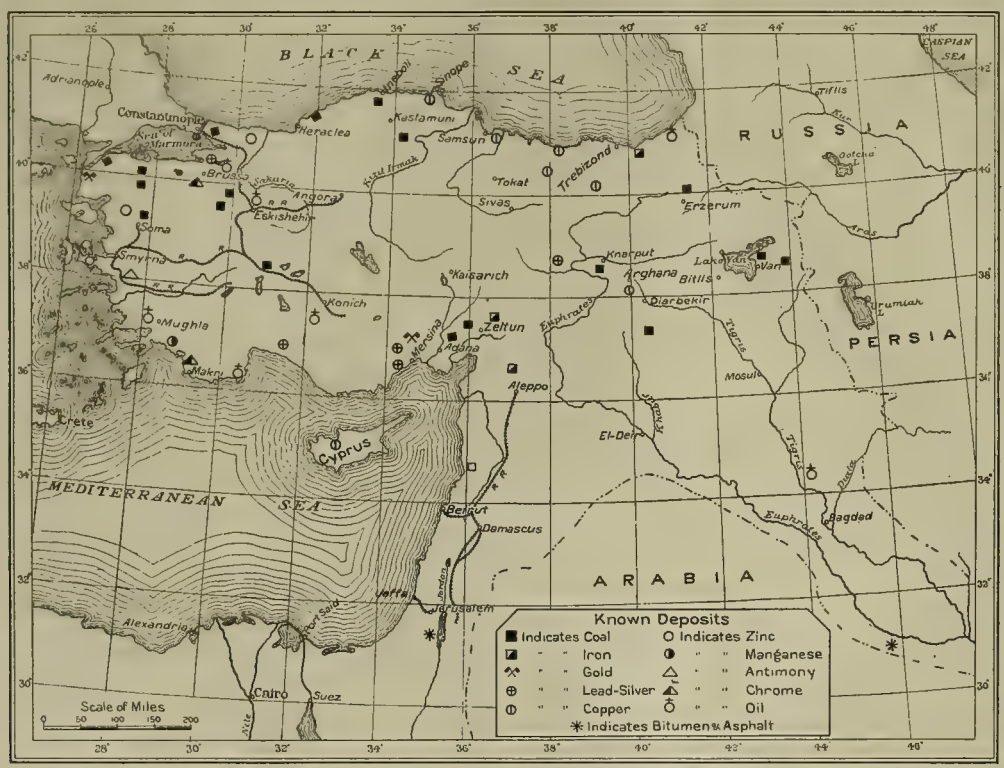
Fayetteville, Arkansas, May 20.

Public interest in the desert region, which comprises an area of about 68,000 square miles, is intense, largely because of the discovery and development within it of mines that are heavy producers of gold. The resources of the desert, however, are not confined to the precious metals, but include many other products of economic value, among which may be mentioned several valuable salts, including borax, soda, gypsum, and common salt; building material, including marble, onyx, brick clays, and cements; baser metals, like copper, iron, and lead; and gems, among which are turquoise and opal. These products are widely distributed throughout the desert. A report, with a map showing water-holes and important roads on the desert has just been issued by the U. S. Geological Survey as Water-Supply Paper No. 224.

MINERAL RESOURCES OF THE TURKISH EMPIRE.

Written for the MINING AND SCIENTIFIC PRESS
By LEON DOMINIAN.

In an era when the fostering and conservation of a country's natural resources are reckoned among the objects of enlightened administration, it is instructive to note how the lack of such solicitude has checked the advance of the mining industry within the Turkish Empire, the boundaries of which now comprise the richest mining districts known to antiquity. The areas of Europe and of Asia, included within the Sultan's dominions, have been the seat of active mining operations from about 2000 years B. C. to the end of the eleventh century. Subsequent to this period, centuries of corruption and misrule barred the development of industry. With few exceptions, all that remains today, consists of innumerable old workings scattered throughout the Empire. Turkey in Asia, especially, abounds in mineral wealth. A glance at the accompanying map suffices to reveal the fact that Asia Minor is abundantly mineralized.



Map Showing Mineral Resources of Asiatic Turkey.

An interesting relation between orographic features and the occurrences of mineral deposits is observable. The westernmost projection of the Asiatic continent may be likened to a bowl, the rim of which is partly formed by the coastal mountain chains, the rest being completed by the elevated ranges of eastern Armenia, along the Russian and Persian borders. The interior of the bowl is made up of the plateaus which, so far, are not known to be extensively mineralized. At all events, the bulk of the known ore deposits lie in the folds of the marginal uplifts. Our knowledge of the general geology of the country is exceedingly meagre. Occasional reports from travelers, many of whom were neither geologists nor miners, afford but scant data, and the fragments of reliable information derived from authorities like Tchihatcheff and Spurr are too few to allow generalizations. A splendid field of investigation is undoubtedly open to scientists and technical men.

Any attempt to partition off the map of the country into areas, each of which would include distinct types of ores, irrespective of their mineral contents and with distinction based solely upon the mode of occurrence or genetic nature, would, at the present stage of our knowledge, be useless. Nevertheless, certain minerals are more abundant in some districts than in others. Moreover, an oil-belt has already been recognized by J. E. Spurr. That able mining geologist states[1]: "Oil will probably be found in a general belt which runs southeastward from the eastern part of Armenia on the Black Sea down to the Persian Gulf." Beyond this assumption, with which the writer fully concurs, none but differentiations along similarly broad lines should be attempted at present. The following description will accordingly be confined to an enumeration of the minerals known to occur, with a mention of the localities wherein they exist.

Coal.—The Heraclea coalfield is at present the best developed in Turkey. It occupies a belt about 60 km. in length, along the Asiatic coast of the Black Sea, between the seaports of Heraclea and Filios. The town of Heraclea itself lies at a distance of 135

[1]Eng. & Min. Jour., Oct. 4, 1902.

nautical miles from Constantinople. The coal-beds outcrop near the coast and are not known to extend farther than 8 km. inland. It is believed, however, that they strike southeasterly from the eastern boundary of the district, to which mining operations have been confined, and that they may be re-encountered at a greater distance from the sea-shore beyond. The coast is precipitous and mountainous. The topography is rugged. Narrow valleys and ridges parallel each other at right angles to the shore-line. The coal-measures overlie Carboniferous limestones and are in turn unconformably overlaid by Cretaceous beds of great thickness.

A study of the fossil flora has led to the division of the measures into three series or stages corresponding the Culm, Westphalian, and Stephanian subdivisions of the Carboniferous period in Europe. These are respectively the Aladja-Azy or lower stage, the Cozlou or middle stage, and the Caradon or upper stage. The first two are economically the most important, but the best coal is derived from the middle stage. The entire region has been considerably disturbed by repeated faulting subsequent to the formation of the coal. The veins have a general east-west strike, and dip between 10° and 30° to the south. At certain points, however, the dip is northerly. Again, At Tsamly, vertical seams have been worked.[2] The coal is an excellent type of bituminous, though slightly higher in ash than the corresponding average type from European basins. In this it resembles the Cretaceous product of the Rocky Mountains. It may be divided into two classes: (1) obtained from the veins of the middle series containing from 30 to 40% volatile matter; (2) mined from the lowest stage, containing from 40 to 45% volatile matter. The first is excellent for coking purposes, while the Aladja-Azy product is used chiefly in the manufacture of illuminating gas and for steam generation. The whole region has been held as private property by the lately dethroned Sultan. It is probable, however, that one of the results of his dethronement will consist in the restoration of these deposits to the State, and that concessions will then be granted in compliance with the provisions of the mining laws of the Empire. The district was hitherto worked under special regulations which had nothing in common with these laws. The right of exploitation was granted to Ottoman subjects alone, although transfer could be made to foreigners with the sanction of the Government. Working permits covering circular claims of a diameter of 450 metres could be obtained upon application, the centre being taken at the point where operations were actually started. The grantees could dispose of only 40% of the output, the balance having to be held at the disposal of the Government at a price settled beforehand. This balance, however, could be sold otherwise, in case the Government signified its unwillingness to purchase. Furthermore, 10% of the fine passing through screens with 1 cm. apertures, belonged to the Government. In case a mine was not worked during three successive months it reverted to the Sultan. A fixed charge of 5 piasters ($0.22), called the *temetouat*, was collected on every ton shipped. This tax could be paid in kind.

As a rule the mines were opened by means of two or more main slopes at a distance of from 50 to 100 metres apart. Transverse entries, driven along the strike of the veins, subsequently connected the slopes, and were in turn connected with each other by a system of galleries driven every 25 metres. Development proceeded until, as has happened in almost every instance, the vein was cut off by a fault. Then mining was begun, the coal being attacked at the breast of the galleries first. Work was conducted backward, the caving system being applied as the coal was won while the miners receded toward daylight. Half-ton cars running on 60-cm. gauge tracks, were used for tramming the product, although in the narrower galleries, the coal was handled on men's backs in 25 kg. loads. The men worked on the system of day's pay or by the task. The Société d'Héraclée, a French company, and the most important in the district, at first paid wages by the day, but subsequently adopted a straight leasing system. Owing to the waste incurred through negligence on the part of the lessees, this was abandoned and replaced by task-work entirely.

By far the largest proportion of the output is hauled over the French company's narrow-gauge railway to Zoungouldak harbor, where cranes of 4 tons capacity, capable of handling 3000 tons in 24 hours, discharge directly into the holds of vessels. The mines at Tchatal-Azy are connected by an aerial tramway to the Usulmez railway station. The output from all the mines during 1907 amounted to 625,000 tons. During 1908 about 200,000 tons was consumed in Constantinople alone. About 100,000 tons is shipped annually to various important points, such as Smyrna, Bourgas, and Galatz. Over one-half of the annual production is sold at Zoungouldak to steamers that call there to coal. The ton-cost of the product, laid on the wharf, is stated to be $1.45, out of which 88c. is charged to mining. The freight rate to Constantinople is $1.20 per ton. During 1907, 20,000 tons of coke was produced from two batteries of 50 coke-ovens of the Coppée-Bernard system. A large portion of this coke is sold to the Laurium smelters in Greece, the balance finding its way to Marseilles.

In addition to the Heraclea basin, coal-beds are extensively distributed, both in European and Asiatic Turkey. Lignite appears to be abundant throughout the European provinces of the Empire. At Dedeagatch, Soufli, Ouzoun-Keupru, and Keshan, all in the Province of Adrianople, several beds of lignite coal have been opened, and it is claimed that exploration has led to satisfactory development at the last named point. Lignite is also reported from the vicinity of the seaport of Rodosto on the Sea of Marmora. Prospecting for coal has been done in the neighborhood of Grison-Assar, at a distance of three hours from Xanthi's railway station. Farther west thick seams of lignitic coal have been discovered in the Provinces of Salonica and Monastir. In Albania a fair quality of coal has been mined near the towns of Telvino and Triano. Deposits of lignite are also

[2]S. Stassinopuolos. Bull. Cham. Com. Franc., Oct. 1908.

known near the villages of Akbrunar, Tchiflik, and Aghatchly at a short distance from Constantinople.

Passing to Asia Minor, it appears that the northwestern portion of the peninsula also contains seams of lignitic coal. These, in all probability, can be correlated with the European beds. Indeed, 40 years ago, the Russian geologist, Tchihatcheff, called attention to the fact that the European and Asiatic provinces immediately bordering the intervening seas constituted a single geological province. In the neighborhood of Ismid and farther west at Lampsacus, lignite beds have been found, but, to date, they have not been largely exploited. At Manjilik, however, in the extreme northwest of the peninsula, there is a lignite mine where thick seams outcrop for a length of 2½ miles. This deposit is worked by the Société Anonyme Ottomane, owning the near-by lead mines of Balia. The product is used as fuel for an electric-power station feeding the lead mines. Farther south, a short distance from Soma, the terminal of a branch line from Manissa, a good quality of lignite has been mined on a small scale. Southwest of Tchai railway station, between the towns of Kara-Hissar and Ak-chehir, a 6½-ft. seam of hard coal has been uncovered. At Kuré, between the railway stations of Eskichehir and Bilejik good thick seams of lignite are worked. Near Adana, in southeastern Asia Minor, are veins of bituminous coal. Explorers have also noted fragments of anthracite in the vicinity of the ancient town of Sis. In the Province of Beyrut two relatively important deposits of lignite are worked. One lies near the village of Kermael and yields about 1000 tons annually. The other occurs in the valley of the Nar-el-Kalb and produces about 500 tons per year. It is claimed, however, that both deposits are capable of a larger output.

North of the Arabian desert, in the Provinces of Diarbekir and Memouret-ul-Aziz, all grades of coal from lignite to anthracite are reported. Anthracite is also reported from the neighborhood of the town of Harput, as well as from deposits discovered between Lake Van and the Persian border. The probable existence of an anthracite basin in this vicinity is further corroborated by discoveries of high-grade coal near the town of Palou and at Tchinvich-Kezek, not far from the Euphrates river. At about 50 km. northwest of the town of Erzeroum, a lignite mine yielded 100 tons in 1900, and his since been worked on a small scale by the municipality. In the Province of Castamuni, along the Black Sea coast, what is claimed to be an important field has been discovered at Bije near Amasra. At 18 hours distance from the town of Ineboli, as well as at various near-by points, anthracite is found.

Iron.—Little is known regarding the occurrence of iron-ores within the Turkish Empire. In the Province of Trebizond, blacksmiths melt in a crude fashion certain ores obviously derived from neighboring localities. The product is used in the manufacture of implements of daily usage. The Zeitun district, at the foot of the eastern slope of the Anti-Taurus mountains, in southeastern Asia Minor, is said to contain extensive deposits of high-grade iron-ores, and it is known that blacksmiths throughout Syria and Mesopotamia obtain their iron from the natives working these deposits. Iron mines are also worked in the vicinity of Aleppo. In western Asia Minor iron-ores have been discovered at Vierla and Bazarkeui. In European Turkey there exists a deposit at Gumuljina in the Province of Adrianople.

Gold.—About 1500 fine ounces of gold is produced annually in Turkey. In the Kardagh mountains of Macedonia the natives wash auriferous gravels along the banks of the rivers. Gold-ores are known to occur along the Asiatic coast in the vicinity of the Dardanelles, and gold-bearing quartz veins have been discovered in the Bulgardagh mountains in southeastern Asia Minor. There is no reason why this precious metal should not be eventually recovered as a by-product in the extraction of other ores. It will probably be found to occur associated with copper and argentiferous lead-ores, thereby substantially increasing the future production.

Lead and Silver.—The best developed silver-lead mines are in the Province of Hudavendighiar, near the town of Balia, at a distance of about 100 km. from the sea. The ore occurs in a contact-zone between Tertiary augite-andesite and Carboniferous limestone. The contact-zone varies between 6 and 16 ft. in width. The limestone at the contact is silicified but barren. In the andesite, on the other hand, are found accumulations of pure galena which seem to be connected with fissures parallel to the contact-zone.[3] The ores carry galena, blende, and pyrite, and contain on an average from 16 to 20% lead and 8% zinc.[4] The plant at Balia comprises a mill of 400 tons daily capacity for the production of lead concentrate, and a Wetherill magnetic separator for making a blende product. The smelting works are provided with a water-jacket lead-furnace of rectangular section, 1 by 1.8 metres, of 100 tons daily capacity. The slags produced contain 20% Pb, 20 gm. Ag, and 10% Zn per ton. In 1903, the mine output amounted to 63,000 tons, yielding 7600 tons of pig lead, with an average content of 97.5% Pb and 1950 gm. Ag per ton. The pig lead is transported to the coast, whence it is shipped to Frankfort in Germany for refining. Besides the lead product, about 2000 tons of zinc concentrate, assaying 41% Zn is produced annually. The company owns and operates the lignite mines at Manjilik described above. Here an electric-power station has been installed. Generators having a total capacity of 700 hp. produce the current, which is transmitted to Balia and the mines. The average cost of current per kilowatt-hour is 0.09 fr. ($0.017). The smelting costs, including preliminary roasting, are about 60 fr. ($11.40) per ton of ore treated. Milling costs amount to 3.8 fr. ($0.72) per ton.

South of Kurmasti two deposits of silver-lead ores are known, at Dumbeltek and Keskdere. An inspection of the abandoned workings at this point reveals geological conditions similar to those observable at Balia. Sixty-five kilometres north of Mersina, in the Taurus mountains, a silver-lead mine at Bulgar

[3]K. E. Weiss. Zeit. f. Prak. Geol., 1901.

[4]G. Ralli. 'Lead Mines of Balia,' Eng. & Min. Jour., Feb. 18, 1904.

Maden has been worked by the Government. Lack of fuel, and heavy transportation charges to the coast, added to ignorance of mine exploitation methods, prevented profits being made. During recent years little work was done at this mine. About 25 km. northwest of Soma there exists a district from which, according to reports, galena float has been found in association with blende and chalcopyrite. In Turkey in Europe, I have, not infrequently, found galena 'float' in the ravines of Bebek and Rumeli-Hissar along the shores of the Bosphorus. Owing to a variety of causes no attempt was ever made to trace the 'float' back to its source. At Kratova, in Macedonia, old workings in a deposit of argentiferous lead have been unearthed, and it is reported that a British company is about to undertake development.

Copper.—Copper was mined in the vicinity of Constantinople. The island of Halki (a corruption of the Greek word 'Kalkos' meaning copper), lying at the western entrance to the Bosphorus, contains numerous old workings, now mostly caved in. Appreciable quantities of pyrite and chalcopyrite are exposed throughout the island. A similar deposit, on which a little work has been done within the past 50 years, is known at Sariyari on the northeastern shore of the Bosphorus. Farther west, in the vicinity of Rumeli-Hissar, a copper vein has been reported. These occurrences are found along well defined contact-zones between eruptives and limestone. In Asia Minor the existence of a rich copper belt along the eastern portion of the Black Sea coast is suspected. Six different properties are now being operated in the vicinity of the sea-port of Sinope. At Espie, near Kerassunde, important exploration is being conducted on a copper concession thickly studded with old workings. High-grade copper ore is also reported from the vicinity of the towns of Gumushane and Karahissar. In the neighborhood of Trebizond, a number of copper mines are being worked on a small scale. It is interesting to note that this region was the very one which gave origin to the ancient mythical tales referring to the Golden Fleece, fabulous reports of untold wealth to be found on these shores being spread by the early navigators. The celebrated Argana mines are almost due south of the eastern border of the last named district, at the source of the Tigris river. From all accounts very high-grade ore is mined at this point within an area of 12 km. square. The deposit is known to have been exploited since the year 1096 A. D. During recent years, operations have been carried on intermittently by the Government, both on a leasing system and by direct management. Cuinet gives the following analysis of this ore[5]: Cu 30%, Fe 40%, S 30%. Weed[6] states that the ore is high-grade, carrying from 10 to 12% Cu. Mining is conducted in the most primitive fashion. The ore is broken to nut size, conical heaps of the broken material are built and covered with wood to which fire is set. This roasting lasts three days, and is succeeded by a similar operation on the product of the first roast. The resulting matte, containing 25 to 30% copper, is smelted in closed kilns from which the 'black-copper', as it is known to the trade, is finally derived. All of this black copper is transported on camel-back to Tokat, where it is refined and subsequently shipped to the sea-port of Alexandretta. The cost of mining and smelting is estimated at less than 3c. per pound, this being the price paid by the Government, which, so far, has reserved for itself the sole right of purchasing the mattes. Transportation from Tokat to Alexandretta costs 2c. per pound. At the time of writing it was learned that the Government had decided to turn over the mines to private parties. Deposits of copper are also known at Baibour near Honlay as well as at Haire and Bulbuldere.

Zinc.—A deposit of calamine is worked at Karasu, close to the Zakaria river, in the Province of Ismid. The mines are owned by a French company. Other known deposits of zinc ore in the Provinces of Salonica and Adana have not yet been developed. A small amount of work has been done on a zinc mine at Bazar, in the district of Bigha. Zinc has also been discovered at Kirasliyala, in the vicinity of the ancient town of Pergamos.

Manganese.—Two important districts produce manganese ores in Turkey. These are the Kassandra district, in the Province of Salonica, and the Phlinika district in Asia Minor. The ore occurs in both places in the form of pyrolusite, the Asiatic variety assaying 52% Mn. A small amount is also mined at the Zengan mines, with average assays showing 83% manganese dioxide. Manganese mines are also worked in the Province of Trebizond. Occurrences of these ores are, moreover, known in the vicinity of the sea-port of Moudania, as well as near Seshkeui, Balia, and Ushak, all in Asia Minor.

Antimony.—Stibnite has been found in the Provinces of Adrianople and Monastir. Near Rozdan, the ore occurs in a clay gangue at a contact between schist and dolomite. Considerable work has been done here. The ore is concentrated on the spot to about 55% antimony, and is then shipped to European points. Other localities where stibnite is found are the islands of Mitylene and Chios in the Archipelago. Some development work has been done on the former, but no attempt has been made to establish a steady production. In Asia Minor most of the deposits are found in the Province of Aidin, whence shipment is made chiefly to England by way of Smyrna. The two important centres of production in this Province are Eudumish and Djinli Kaya, in both of which high-grade ore is found, often carrying as much as 65% antimony. At the last mentioned point the veins occur cutting through crystalline schist. The Gomekchiflik mine lies on the southwest slope of Kisil mountain. This mine has been leased for 13 years to Greek contractors on a royalty basis.[7] About 100 men are employed during nine months of the year, the output for that period averaging 500 tons of sorted ore. Other deposits are known at Demirkapou, Sulukeui, and Ivrindi, all in western Asia Minor.

Arsenic.—The Turkish mines yield about 3000 tons

[5]Vital Cuinet, Turquie d'Asie, Vol. 2, p. 481.

[6]'The Copper Mines of the World', by W. H. Weed.

[7]K. E. Weiss. Loc. Cit.

of orpiment annually. This mineral is usually found associated with antimony. The mines at Elkhur, near Rozdan, produce 500 tons per annum. The ore is found in the same veins that carry the stibnite, but in pockets free from the presence of this last named mineral. Most of the product is shipped by way of Salonica to France, a small proportion being reserved for home consumption. The mines near Yenikeuy are important. They are noted for the excellent quality of their ores, which run as high as 42% arsenic. Some gold is present. About 1000 tons of this ore is shipped every year to Europe. Orpiment mines also exist at Togan-Hissar, near Dedeagatch, in the Province of Adrianople and at Eyriden, in the Province of Salonica. Arsenical pyrite has, furthermore, been found in the Eudumish deposit described above.

Chrome.—Turkey has contributed largely to the world's supply of chrome ore. The Turkish ores are soft, rich in chromic oxide, have a low silica content, and are free from objectionable impurities. In European Turkey some mines are worked near Salonica, the ore from which assays between 48 and 52% chromic oxide. The principal districts are those of Kamene and Roshdan. In Asia Minor the mineral is of widespread occurrence throughout the west. It must be stated, however, that the production has fallen off in recent years. The most important mines were those of Dagardy, south of Mount Olympus, in the Province of Hudavendighiar. From estimates made in the course of the year 1900, the existence of an orebody in this locality, measuring 120,000 cu. ft., and containing 50 to 56% ore was surmised. Another important district was that of the basin of Macri, of which the seaport of that name facing Rhodes Island, was the chief point of shipment.

Asphalt and Bitumen.—Asphalt springs are known at Polina, near Durazzo, in Albania, also at Avlona in the same province. A small amount of work has been done at this last point, whence the output was shipped to Trieste. The most important bitumen field known lies in the region formerly called Judea, in Asia Minor, which now constitutes the Provinces of Aleppo and Syria. As far as can be gathered from available statistics the production during the past 20 years has averaged 10,000 tons annually. Starting from the southern extremity of the Dead Sea to the source of the river Jordan, the deposits lie along an axis parallel to that of the basin. They occur as impregnations in a Cretaceous limestone. The most extensive of all is the one at Nebi-Musa which reveals itself on the surface in large bluish patches. That of Hasbeya, at the northern extremity of the Jordan, is analogous to the former, but not as rich. At the time of the Egyptian conquest Hasbeya was the seat of regular working, and the remains of some twenty pits can still be seen. Bituminous springs have also been found opposite the town of Nasarieh in the Province of Basra.

Petroleum.—The district around Bagdad, in the southeastern portion of Turkey may acquire importance as an oilfield. Around Cherizor the natives sink pits in order to collect the greasy liquid which seeps through the loosely consolidated rocks. As a matter of fact, oil seepages have been traced all along the Iranian mountains from Erbil to the Persian Gulf. In northeastern Armenia indications are not wanting that the Baku oilfields continue into Turkish territory. On the southwestern coast of Asia Minor, north of Cape Chaledonia, gases are continually escaping from fissures in a peridotite rock intruded in limestone. This phenomenon has been observed for 2800 years, and may have economic significance, as it has been recognized that the escape of gases are usually associated with oil. Indications of oil have also been found in the vicinity of Lake Isnik in the sea of Marmora basin.

Borax.—Extensive beds of pandermite, a massive and not entirely pure variety of colemanite, a calcium borate, are mined at Sultan-Tchair, in the Province of Hudavendighiar. The mines lie on the mail-route leading from Panderma harbor to Balikesser. According to Weiss the pandermite occurs in Tertiary sedimentaries lying in a basin surrounded by steep hills of gabbro, granite, and crystalline schist. The productive bed consists of a brownish to bluish gray gypsum, containing nodules of variable sizes dispersed within the gypsum, and forming from 10 to 20% of the aggregate mass.

Lithographic Stone.—This substance occurs in extensive massive beds north of Mihailich, also east of Kimashti, and south of Abulonia lake.

Emery.—The production of emery from Asia Minor and the islands of the Aegean sea practically constitute the bulk of the world's supply. The output of the former exceeds that of the latter. The mines lie in a belt extending 200 miles south and southeast of Smyrna. Noteworthy localities are Cozburnar and Azizie on the Aidin railway, 50 miles south of Smyrna. The ore is found in lumps up to 5 in. diam., embedded in a red-brown clay, and associated with fragments of calcite. Other producing localities in this district are Hassan-Chauslar and Soka. The cost of production at the mines is estimated at $8 per ton. About 60% of the total production is shipped to the United States.

Meerschaum.—The plains near Eski-shehir, in Asia Minor, constitute one of the important localities from which this hydrous silicate of magnesium is mined. The meerschaum district extends from the town of Eski-shehir, on the Anatolian railway, almost due eastward to the city of Angora. The mines lie at a distance of about 22 km. from the railroad station, to which the ore is packed by camel trains. The two chief producing mines are those of Saresu and Sepki. The deposits occur in a valley filled with drift material from the surrounding mountains. The sepiolite is scattered through the drift in rounded nodular masses with fragments of magnesian and hornblendic rocks. As a rule the nodules to not exceed 3 in. diam., but a few attain larger dimensions. In the raw condition the mineral is soft, light, and nontransparent. The color is white, with occasional blending of yellow, red, or gray. It is richer in silica than that found in Utah and North Carolina. The thickness of the meerschaum-bearing strata varies between 10 and 130 ft. Mining is carried on by means of the leasing system, both in open-cut and underground work.

Mercury.—Two deposits of cinnabar are worked at present in Asia Minor. The Karabournou mines, situated about 30 km. from the town of Smyrna, produce about 3000 flasks annually. The deposit lies in the vicinity of basaltic flows, and consists of metamorphic silicious schist impregnated with cinnabar.[8] Mining is done entirely in open-cuts on ores containing as little as 0.25% Hg. When sorted the cinnabar appears to concentrate in the fine, and the ore is accordingly screened. The concentrate assays from 0.75 to 2% Hg. The plant at the mine comprises two double Spirek tower-furnaces for broken ore, and a Cermak-Spirek furnace for fine. This installation has a capacity of 30 tons per day. The other deposit occurs in the vicinity of Konia in Asia Minor.[9] Here the ore is found in veinlets, nodules, and small particles, in a crystalline limestone close to schist, at no great distance from old eruptives. The mineral appears to be present wherever the limestone becomes silicified. Some stibnite is associated with the cinnabar. Up to the middle of the year 1905 about 15,000 tons of 1% Hg had been opened up.

The foregoing review should not be considered merely in the light of a retrospective survey, but rather from the standpoint of future development. That a good deal of mining has been done to date, despite extremely adverse conditions, is a good portent. It is highly probable that copper mining and smelting will be carried on extensively along the eastern Asiatic coast of the Black Sea down to the sources of the Tigris and of the Euphrates rivers. There is also promise of a rich oil belt in the vicinity of, and running parallel to, the Russian and Persian frontiers. The development of a thriving coal and coke industry in Asia Minor is a possibility within easy reach of capital and energy. The Macedonian provinces are already known to contain a variety of minerals, and must necessarily become the seat of active mining camps. The same can be stated of western Anatolia. Flourishing industries, however, are perforce subordinate to the existence of order and peace. Fortunately, there is reason to believe that the men at the head of the present administration intend to carry out a broad-minded policy that will favor the expansion of mining and its allied industries. With the adoption of such a course, many interesting features of technical practice in Turkish territory will doubtless be revealed within the next decade or so. Most mining engineers are familiar with the admirable results obtained in Mexico, within a comparatively short period of time; nor is the result of push and energy in our own Far West less striking.

Comparisons are instructive at times, and it were futile to belittle the importance of granting due recognition to modern industrial tendencies as exhibited in the practice of the more advanced nations. A study of these features and the causes conducive thereto may advantageously shape the policy to be adopted by those upon whom the responsibility of developing a country's natural resources has been thrust.

[8]F. P. Monachi. Rassegna Minerara, April 11, 1908.
[9]F. F. Sharpless. Eng. & Min. Jour., Sept. 26, 1908.

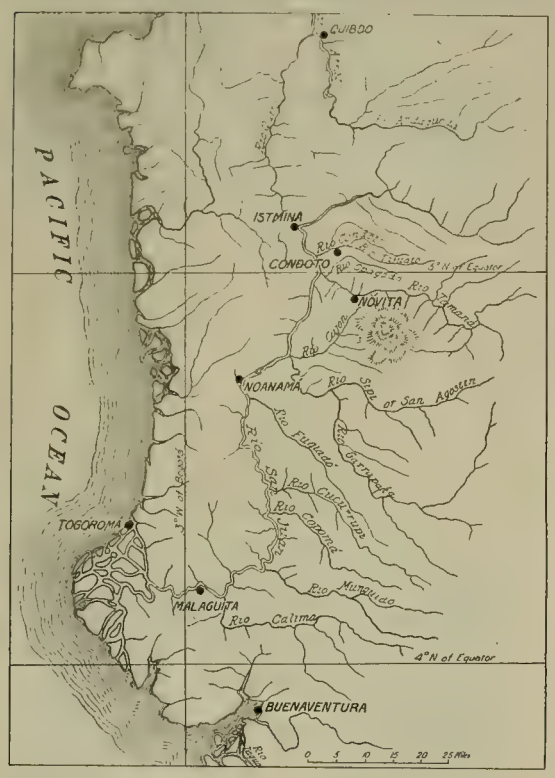
GEOLOGY OF THE PLATINUM DEPOSITS OF COLOMBIA.

Written for the MINING AND SCIENTIFIC PRESS
By J. CICERÓN CASTILLO.

On the west slope of the Andes, in the Republic of Colombia, is being developed an enterprise with a solid future. This is contemporary with the new San Francisco, since, by a singular coincidence, it has been developed within the same epoch that the fallen city has lifted itself from the ashes. In April, 1906, G. H. Nisbet sailed from San Francisco to Buena Ventura, a port on the Pacific coast of Colombia, to superintend the work. Mr. Nisbet had just returned from Russia, and was especially familiar with platinum deposits, and it was for this reason that he was selected to explore the only known deposits of platinum on this continent. These alluvial treasures, which will soon be exploited on a large scale, will within a short time become the scene of dredging operations. Keeping step with the investigation of the economic side of the problem, the petrology has also been studied in the mountains. It occurred to the author to make a geological excursion in search of the origin of the alluvial platinum, which constitutes one of the great and peculiar riches of Colombia. In this particular case the float now gathered as gravel into the streams was not of the character which usually accompanies the gold in that region, but revealed a series of unusual rocks. The San Juan valley, famous for its auriferous gravels in its upper part, was the most notable mining centre in Colombia in the Colonial epoch, and was known as the Chocó, which has been described to the world by Baron Von Humboldt. History assigns a production of $600,000,000 to this region from the sixteenth century to the end of slavery in the past century. Five thousand negroes were transported by the Spaniards directly from Africa, and the descendants from these constitute today 75% of the population of the Province. It is not the object of this article to give an account of the days of Spanish gold mining, which in their magnitude are comparable only to those of California, but it is desirable to record that, slavery having been terminated, the negroes remained practically the owners of the territory, having continued until the present time on their own account and initiative as workers with *batea* and sluices. These people have no incentive for work, because Nature is so prodigal that want of food is entirely unknown, and there is so little demand for clothing that the breech-cloth is practically the only garment used. Notwithstanding the absence of necessities as an incentive to labor, the annual mineral production of this district as pursued today will not fall below $300,000 gold, and it is constantly augmenting. The increase in the price of platinum was directly responsible for the growth of mineral exports from the Province of San Juan. During the Colonial epoch platinum had little or no use in the arts. The Spaniards cast it aside as one of the 'impurities' encountered in their mining for gold. The river Condoto, which is today almost the sole producer of platinum, contains very little gold, and the platinum in these

gravels greatly disturbed the early miners. The Condoto accordingly escaped being worked by the Spanish miner of those times, and its alluvial deposits are practically intact. The workings of the last 10 years have been more in the nature of prospecting made by the natives in search of easy riches, and it is surprising how that multitude of workings here and there, after having yielded in places two or more dollars per cubic yard, is still valuable as a basis for operations by a company which has obtained possession of the river and its dredgeable gravels.

In order that the reader may better understand the conditions, it is desirable to call attention to the map which accompanies this article, showing the geographical position of the gold and platinum deposits. A north and south depression, due to geological



Map of the Choco, Colombia.

causes and not to erosion, almost results in a union of the Atrato and San Juan valleys. This depression was evidently formed before the Tertiary era, and there is evidence that it connected the Atlantic with the Pacific ocean prior to an uplift, which evidently occurred during or after the Cretaceous period. The origin of the platinum is to be found in the eruptions which occurred subsequent to that period, as is evidenced by the character of the gravels accompanying it. The geological evidences at present available point to an overflow of rhyolites and trachytes, which cover the western slopes of the Western Cordillera of the Colombian Andes. This was of exceptional duration, and buried the ancient andesitic formation under thousands of feet of Tertiary lavas. These were exposed in a later epoch by erosion which has cut deep valleys, following the volcanic activity referred to. The lava covered practically the entire surface throughout this region, which constitutes the hydrographic basin of the San Juan river, the only portion of the country which the author has had an opportunity to study. The rapidity of the cooling of these volcanic rocks is evidenced by the absence of crystallization in the Tertiary rocks. No obsidian, however, has been discovered in the district. The rapid cooling referred to produced an incalculable number of shrinkage cracks, which were subsequently filled by gold-bearing quartz deposited from hydro-thermal solutions. The platiniferous rocks are actually intrusions, and their appearance on the surface of the earth at this point was subsequent to the formation of Tertiary lavas, through which it was injected after the gold had already been deposited along with the quartz. As a result of these intrusions, the opportunities for carving out new watercourses by erosion were multiplied. These cut the orographic axis of the Cordillera and add many affluents to the river San Juan.

A great flood period, comparable to the Champlain, has displayed itself since the final volcanic activity, and the conditions which it produced, and which to a considerable extent are paralleled today, have contributed, even down to the present time, to the enormous work of cutting down the rocks with their precious-metal contents and forming the first alluvial deposits. Many of the gravels have been transported great distances, and many of the original deposits have been eroded a second time, resulting in concentration, which has produced in certain cases fabulous riches. These frequent changes have resulted in leaving great areas of gravels without any soil covering, so that they are available for dredging. It only remains to add that subsequent volcanic eruptions of a local character have occurred within recent epochs, which have left their mark written in the material of the alluvial deposits, demonstrating, as in the valley of the San Juan, which today empties into the Pacific, that it formerly discharged its waters into the Atlantic, and that these changes in direction occurred apparently several times. There are indications that even the tides may have affected this region, and may have flowed across from what is now the valley of the San Juan into the valley of the Atrato.

The mother rock of the platinum in Colombia is a volcanic in which pyroxene predominates, together with feldspars. It is a quite typical gabbro. The rock in which the author has had the fortune to find platinum is found in characteristic dikes, after the manner of veins. It is almost as black as jet, but is made up of a dense mass of pyroxene crystals containing pyrite, in which the platinum occurs in the metallic state. The same rock also shows small quantities of nagyagite.

The basin of the Condoto river is the centre of platinum mining in Colombia. At the present time there are no deposits elsewhere in the world which contain so large a quantity of this metal. It is characteristic of the alluvial deposits of the Condoto that the platinum predominates absolutely above the gold in point of quantity by weight, the platinum constituting from 75 to 80% of the metalliferous content of the samples. Many observations, made by the author, on

these deposits have brought him to the conclusion that the growth of gold particles within these placers by precipitation from solutions has not taken place, but that the metal has been brought by mechanical means exclusively. Each particle of gold, on being broken loose from its quartz gangue, and by the oxidation of the sulphide of iron which imprisons it, loses consecutively a part of its weight. The nuggets, however large they may be, show evidence of having been worn and reduced in size; that the platinum existed originally in the gabbro is a fact which the author has proved. It is present in the same manner as tin oxide (cassiterite) is contained in granite. It is interesting to note that this black gabbro follows the platinum wherever it is found in the upper valley of the San Juan, so that the color of the gravel is at once an indication as to whether it is platinum-bearing or whether it is gold-bearing. The gold-bearing gravels are whitish and reddish in color, while the platinum, owing to the gabbro, have a bluish-black color, which is extremely characteristic.

The separation of the gold from the platinum-bearing gravel is so sharp that it was by this means that the author was able to trace up the platinum to its source. While gold is found, as before stated, in conjunction with the platinum in the gravels, in those which are especially auriferous, no platinum whatever is discovered. The Condoto is at present under control of a company which is having a dredge built by the Risdon Iron Works of San Francisco. This will soon be in operation. At the present time the company is obtaining good returns from washing the patinum-bearing gravels by the old crude methods which have been in vogue for over a hundred years. The author has made extensive tests and has demonstrated the existence of valuable platinum placers through a length of valley of more than 30 miles.

PRECIPITATION OF GOLD BY CARBONACEOUS MATTER.

By W. A. Caldecott.

*The fact that gold is precipitated from auriferous cyanide solution by charcoal has been well known for many years, and finely crushed charcoal has actually been employed as a precipitant in place of zinc in certain Australian cyanide plants.†

In the ordinary limekiln alternate layers of fuel and limestone are fired, so that the burnt lime is usually contaminated with unconsumed carbonaceous matter. Wood is used in some mining districts for burning the lime employed in cyaniding, and although such burnt lime usually contains appreciable quantities of unconsumed charcoal, yet the deleterious effects of such a constituent, which increases in proportion to the amount of lime used, does not appear to have been seriously considered. Many hundred tons of burnt lime are used monthly in cyanide plants in South Africa, and usually contain unconsumed carbonaceous matter from the coal employed in burning. That the bad effects of this ingredient should be recognized as causing loss of gold, by precipitating it from solution in the sand and slime charges, is shown by the following tests, among others: (a) A sample of partly burnt coal from commercial lime was crushed through a 20-mesh screen; 34 gm. of this powdered coal and 1105 c.c. of 0.02% working cyanide solution was given 6 hours intermittent agitation in a filled and closed flask, followed by 12 hours contact, when 0.09 dwt. of gold per ton was found in the filtered solution, while the carbonaceous precipitate assayed 0.49 dwt. per ton of solution, so that 84.5% of the gold had been precipitated. (b) 17 gm. of coal from burnt lime was crushed through a 30-mesh screen, and added to a litre of 0.021% of working cyanide solution, assaying 0.51 dwt. per ton, in a large dish. The mixture was stirred occasionally for 8 hours, followed by 14 hours quiet contact, when on assaying the filtrate it was found that all but a trace of gold in the solution had been precipitated. (c) A glass tube, ⅝ in. diam. and 12 in. deep, was filled with finely crushed, half-burnt coal, excluding the 90-mesh grade, from commercial lime, and 2850 c.c. of working cyanide solution assaying 1.34 dwt. per ton was slowly percolated through the column during 26.25 hours. The percolate was assayed at intervals and showed only traces of gold.

Tests with fresh unheated coal showed little or no precipitating effect from a cyanide solution, which appears to indicate that the precipitating agency in coal which has been partly coked by heat does not exist in fresh coal, but is probably due to the hydrogen formed by the decomposition through distillation of coal, and occluded in the residual solid.

Assuming that ordinary burnt lime contains only a small fraction of 1% of carbonaceous matter, this is equivalent, in a large plant, to several pounds of precipitant per day, which comes in contact with dissolved gold in the sand and slime charges. It is, hence, obviously desirable to use lime which does not contain carbonaceous matter. In case it is impossible to obtain lime free from carbonaceous matter, the only remedy appears to be to dissolve the lime required in the mill-service water before entering the battery. Water can dissolve about 2½ lb. of calcium oxide per ton, and since only dissolved lime is efficient, it would thus be possible, though somewhat troublesome, to prevent the carbonaceous matter in the lime from coming into contact with the ore at all, provided that all insoluble matter were settled in the mill-service water-tanks.

Since carrying out the above experiments some work has been done at the Knights Deep to utilize the precipitating effect of half-burnt coal, and a good many tons of waste acid solution have been passed through an extractor box containing crushed granular fragments of coal (between 10 and 100 mesh), sorted from the ash-dump, with the result that a coal product assaying 12 oz. per ton was obtained. It has also been found that some base metals, such as copper, lead, and mercury, are likewise precipitated from their solutions by coal which has been heated. In view of the results obtained, the application of this method of precipitation has been provisionally protected by patent in the usual manner, and attempts are now being made to develop it.

*Read at meeting of Chem. Met. & Min. Soc. of S. A., April 17, 1909.

†W. H. Gaze's 'Practical Cyanide Operations', pp. 121 et seq. 1898.

ARTEAGA DISTRICT, CHIHUAHUA, MEXICO.

Written for the MINING AND SCIENTIFIC PRESS
By W. B. WINSTON.

The district of Arteaga lies in the southwestern part of the State of Chihuahua, on the western slope of the Sierra Madre. The nearest town of importance is Chínipas, situated on the Chínipas river, about eight miles distant toward the east. At present the nearest railroad connection is the city of Alamos, Sonora, the terminal of a branch of the Cananea, Rio Yaqui & Pacific. The distance is about one hundred



Chinipas, Chihuahua.

miles, half of which is traversed by a good wagon-road to San Bernardo, and the rest by a good mule-trail. Additional and better shipping facilities will, however, be provided in the near future. The Kansas City, Mexico & Orient railroad is now engaged in the construction of a line from Topolobampo, on the Gulf of California, to Miñaca and Chihuahua, and trains have for some time been running from the City



Guadalupe Mine.

of Chihuahua to Aguatos. There remains but a small portion to complete, when the road will be in full operation. The Arteaga district is only about 50 miles from this new railroad.

For shipments by water the port of entry at present is Agiabampo, on the Gulf of California. Freight charges from San Francisco to the mine amount to about $45 per ton of 2000 lb., including transportation to San Bernardo and thence into the mountains by mule-back.

The district of Arteaga is highly mineralized and has been an abundant producer of gold and silver since the early days, when many properties were worked.

A series of parallel fissures traverse the district from north to south, and where not covered by overlying rhyolite can be traced on the surface at many places for a distance of over 3000 metres, with a fairly constant width and strike. The average width on the surface is from 5 to 8 ft., whereas in the underground workings it ranges from 4 to 30 ft., or even more. This increase in the width is generally to be attributed to the intersection of spurs or feeders, and these



On the Road From Alamos to San Bernardo.

produce strong local enrichments. The junctions generally occur on the hanging-wall side. These fissures occur in a fine-grained diabase dike which intrudes through the granite.

The veins dip 25 to 30° east, as far as the deepest workings show, and the diabase on both the foot and hanging walls is remarkably smooth and firm. So much so that stopes over 200 ft. high by 200 to 300 ft. long and 4 to 30 ft. wide, have been standing with-



Chinipas River, Showing White Chief Mine Buildings.

out timbers for over 50 years and are today perfectly safe.

The vein-filling is a bluish white quartz, yielding in places to a brecciated material. The best ore found in the district is quartz containing argentite, with sulphide of iron and free gold. The ratio of silver to gold is about forty to one. The ore yields readily to treatment, giving about 50% recovery of the gold on the plates.

Water for milling and other purposes is available in sufficient quantity from the Chínipas river, and wood for fuel and mine-timbers is obtainable at reasonable cost. The wood used for fuel can be laid down at the mine for ₱7 per cord of 128 cu. ft., and

hardwood or pine timbers 8 to 12 ft. long by 8 to 12 in. diam. cost about 12½ cv. per linear foot delivered, while ordinary pine wood is delivered for ₱60 per 1000 ft. board measure.

Mexican labor can be had at all seasons of the year, the usual wages being ₱2 per day for mill hands, stationary engineers, and the like; ₱1.50 to ₱2 for miners, and ₱1 per day for peones and laborers. The climate is agreeable, being neither hot nor cold, and it has its wet and dry season—in fact, two each year. The first wet season extends from the end of June to September, and sometimes into October; a dry season then intervenes until December or January; during January and February occur winter rains; after which comes the long dry season, lasting until June.

The principal mine in the Arteaga district is that of the White Chief Mining & Milling Co. Its properties consist of the following: Guadalupe, East, West, and North Extensions of the Guadalupe, the Carmen, One and Two, the San Miguel del Castillo and Extensions, Mina Grande, and Veta Madre, embracing altogether 57 pertenencias, or about 120 acres of mineral ground, together with 700 acres of additional land. The claims composing the group extend for a distance of 6000 ft. along the strike of a series of parallel veins varying in width from 3 to 8 ft., and giving values of from $3 to $8 gold on the surface. These croppings are readily traceable except where the lava capping covers the crest of the hills. The Chínipas river crosses the southern boundary of the company's property close to the point where the mill is situated. These mines have probably been worked intermittently for more than 200 years, and judging from the extensive workings and the absence of waste-dumps, both on the surface and underground, the yield must have been considerable, both in quantity and quality.

At present there are about 10,000 ft. of underground workings aside from the open stopes, and most of these are in ore assaying from $8 to $30 per ton. An arroyo running east and west about midway through the property makes it convenient to divide the holdings into north and south groups. All workings in the north group are connected with a shaft about 350 ft. deep, while the south group is worked through adits; work is now under way to connect the south group with the main shaft. The shaft is equipped with a 50-hp. plain slide-valve engine, two boilers, and two air-compressors. Machine-drills are used throughout the mine. Machinery for a new mill has been shipped from San Francisco. The method of treatment consists of crushing the oversize from the grizzly in a Dodge crusher, stamping, amalgamation on copper plates, sizing and concentration on Wilfley tables. The sand is treated by cyaniding and the slime is impounded. The average working-cost has been about ₱7.50 per ton for mining and milling, including development work. The concentrate, precipitate, bullion, etc., are sold on the ground to an agent of the National Metal Company.

I was told that the gross value of the probable ore is about $500,000. At present the White Chief M. & M. Co. is employing 150 men.

The most important mines adjacent to the district of Arteaga are the Palmarejo and Mexican Goldfields Limited. These properties have been steadily producing for more than 100 years, and as late as 1906 had an output of ₱75,000 monthly. The Geraxelterana, Santa Barbara, Monterde, Durasnos, San Augustine, and several other properties are the producers of the adjacent Palmarejo district. There are also many smaller properties in a state of development. Besides gold and silver, both the Arteaga and Palmarejo districts are producers of copper and lead to some extent.

The Clinton formation lies on the flanks of a nonsymmetrical anticlinal valley, extending northeastward for about 50 miles, with the city of Birmingham near the middle. Only on the east limb of the anticline in Red mountain, near Birmingham, is the ore of commercial value. Northwest of this valley lies the Warrior field, containing coking coals, while to the southeast lies the Cahaba field, containing high-grade steam and domestic coal. Cambro-Ordovician dolomite within the valley and Mississippian limestone between the ore-outcrop and the coalfields both afford stone for fluxing. The topography is of the ridge and valley type, favorable for transportation lines. The ore is of sedimentary origin. It contains approximately 36% iron, 12 to 25 silica, 8 to 20 lime, and 0.33 phosphorus. It occurs in beds like coal, but they are subject to residual enrichment on the outcrop; also they are not so broadly extensive as coal beds. Studies of the strike-sections of the ore on the outcrop and of sections at right angles to the outcrop by means of mine-openings and drill-records show that the beds are long, narrow, lens-like bodies. The quality of the unweathered ore is fairly constant in the direction of the dip. All the facts obtained during recent geological surveys of this field, according to Ernest F. Burchard, indicate that the ore is the result of original deposition of ferruginous sediments.

Mining in the southern Appalachian region dates back to the beginning of history in America. The principal mineral resource is gold. When the early Spanish explorers came to America they were shown by the Indians rich nuggets and ornaments of gold from the southern Appalachians. The Spaniards mined gold in Georgia in the seventeenth century. From 1825 to the present time production has been continuous. Unfortunately, no reliable statistics of the production are to be had, but to judge from available data it seems probable that the total value of the gold mined has been about $10,000,000. A considerable but unknown proportion of this amount has been derived from placer deposits, but much the larger part has been won by hard-rock mining. Iron has been mined in the southern Appalachians, and within recent years the monazite industry has attained importance in the Carolinas. Copper, lead, manganese, pyrite, mica, barite, corundum, clay, limestone, and granite have also been found and worked. Besides these minerals, tin ores occur in this region.

THEORY OF THE SETTLEMENT OF SLIME.

Written for the MINING AND SCIENTIFIC PRESS
By HARRISON EVERETT ASHLEY.

A paper on the settlement of slime, by H. S. Nichols, appeared in the MINING AND SCIENTIFIC PRESS, July 11, 1908. From the study of clay-working slips I can add information from a different view-point. In most respects what I submit is supplementary.

In that article no reference was made to the viscosity of the liquid medium. Viscosity is defined as the measure of the internal friction of a fluid. The viscosity of water is commonly taken at a given temperature as unity. In Fig. A is reproduced graphically the variation of the viscosity of water with the temperature. The viscosity decreases as the temperature rises. As the data given in Landolt and Börnstein's tables extend only to 70° C., it was necessary to extrapolate to get the value for 88° C., the highest temperature used by Mr. Nichols. In his Fig. 2, the settling curves for various temperatures are practically straight lines, so that the intersections of the ordinate for any number of millimetres settled should be in about the same proportions. Taking the 140 mm. ordinate, the following table has been prepared:



Fig. A.

Temperature, degrees Fahrenheit.	60	100	140	190
Temperature, degrees Centigrade.	16	38	60	88
Viscosity of water from Fig. A...	62	38.4	26.9	18.4
Viscosity of water, multiplied by 3	186	115.2	80.7	55.2
Minutes settling 140 mm., curves for heated liquids	194^1	110^2	82^3	50^4
Minutes settling 140 mm., curves for heated and cooled liquids..	185^7	140^6	80^5	

Superior figures indicate numbers of curves.

From this table it appears that, within the limits of experimental error, the rate of settling is directly proportional to the viscosity of the water, whatever the temperature corresponding. According to Fig. 1, 5, and 6 of Mr. Nichols' paper, the higher the percentage of solids in the pulp the slower the rate of settling. In Fig. B, which gives the results of experiments by A. V. Bleininger (Trans. American Ceramic Society, 10, 394, 1908), it is shown that the viscosity of a clay-slip increases more and more rapidly as the clay-content increases; consequently the diminution in speed of settling shown in Fig. 1, 5, and 6 of Mr. Nichols' paper can be attributed to increase of viscosity with concentration. As clays differ in viscosity at equal concentrations of slips, different slimes should also be expected to vary. Consequently, a

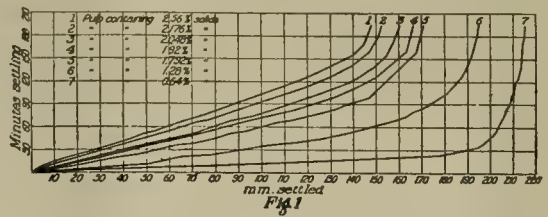


Fig. 1

treatment adapted to one slime will require its proportions to be altered somewhat to apply to another slime.

To explain the other figures, it is necessary first to discuss the various conditions of matter that may be present in a slime. The coarser particles are crystalloid, and are relatively dense and hard as compared with the finer matter. Upon and surrounding the crystal grains is an enveloping film of matter in the 'gel' form of the colloid condition. It resembles gelatine in properties, absorbs water, and shrinks on drying, becoming hard and cementing the grains together. It is less dense than the crystal grains, and will settle slower than them if separate.

If a large excess of pure water be used, or a proper proportion of a suitable solvent, like ammonia, soda

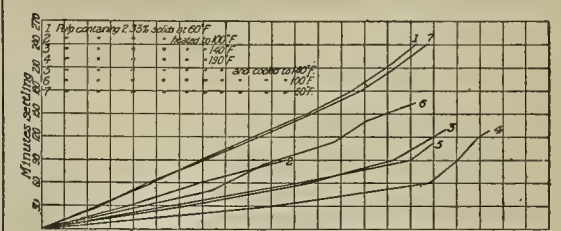


Fig. 2

ash, or caustic soda, the gel is dissolved and forms a turbid suspension which will not settle clear. This is called the 'sol' form. In most cases it is the soluble sodium, ammonium, or potassium compound of a very large and complex polymerized molecule, in which the sodium or other part is an exceedingly small part of the whole. This is illustrated by cases 1a, 1b, 2a, and 2b of Fig. 4 (from Mr. Nichols' paper). If to such a sol, sulphuric acid be added, the acid takes away from it the base that made it soluble, and the gel form of the colloid is precipitated and will settle. If barium chloride or lime is added the reaction is something as follows:

$$2Na \text{ with sol} + BaCl_2 = Ba \text{ with gel} + 2NaCl.$$

The insoluble barium or calcium compound is formed, and will settle readily. If salt (NaCl) is added, it merely 'salts out' the sol; that is, when salt comes into the solution the sol has to go out of

the solution until a solubility-equilibrium is reached. In Mr. Nichols' experiments, as he has indicated, nearly equal results were obtained by the following:

	H_2SO_4.	$BaCl_2$.	CaO.	NaCl.
Mg. per 200 c.c. pulp containing 2.5% solids....	16.68	83.32	55.54	166.90
Chemically equivalent proportions used	0.34	0.77	1.98	2.89

On figuring to a basis of chemically equivalent proportions, it is seen that salt is much less effective than the other chemicals as a cause of coagulation. The lime does not show up very well on the equivalent basis, for a reason to be explained further on.

The fourth condition of matter is that of true solution, into which form the various soluble salts must be brought in order to act as precipitants. Now matter in all four of these conditions is acted upon both by gravity and by electrostatic repulsion. The repulsion is between particles having charges of the same sign. In the case of true solutions, the size of the dissolved molecules is so small that the electrostatic repulsion far outweighs the effect of gravitation, and the particles are uniformly diffused throughout the liquid. The sol is the first step in aggregation; the particles are large enough to reflect light, and while electrostatic repulsion still predominates, the effect of gravity is to make the upper layers of the liquid somewhat less concentrated than the lower. The gel and the crystal are the irregular (or amorphous) and the regular forms, respectively, of the solid state. The opposing effects of gravity and viscosity largely predominate, but electrostatic repulsion is partly responsible for the slow settlement of the finest grains.

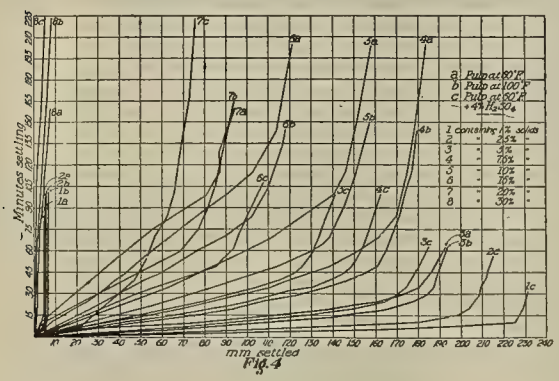


Fig. 4

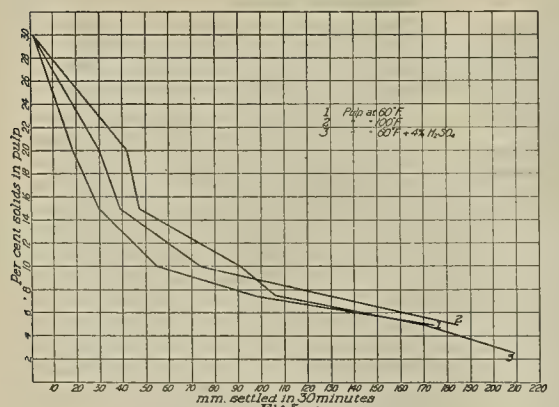


Fig. 5

It was shown above that electrolytes may promote sedimentation by forming insoluble compounds. A second way in which they may accomplish the same object is by decreasing the amount of OH ions present in the liquids. Both OH ions and all forms of clay particles in water are negatively charged. The OH ions appear, with most clays, to have a marked effect in causing the clay colloid to assume the sol form; while a depression of the number of OH ions tends to coagulate the sol and form the gel. The reason for the comparatively weaker action of lime (CaO) as a settling agent is that, while it forms an insoluble compound, it also increases the OH concentration of the liquid, two opposite influences on sedimentation. Sulphuric acid, on the other hand, not only destroys the soluble compound, but it also decreases the OH concentration. With 4% H_2SO_4 the viscosity is about 6% greater than that of water, but these other effects predominate. Sulphuric acid is therefore a most effective coagulating agent.

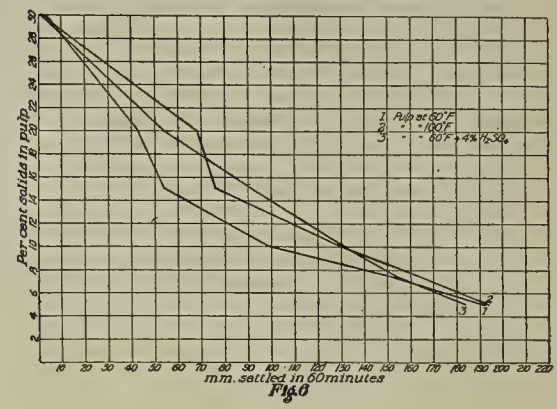


Fig. 6

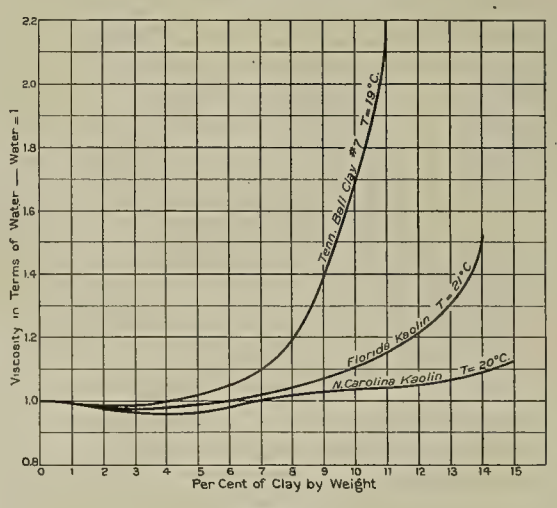


Fig. B.

Mr. Nichols' fourth deduction, that close packing of the clay particles will render the electrolyte inefficient and finally of no avail, is not exactly in accord with clay-working experience. Carbonate of soda (Na_2CO_3) is commonly added to clay slips, with the result that they require about half as much water to be capable of pouring as would be the case without the addition. Addition of acid sufficient to neutralize the soda stiffens such a slip again. This example is, however, with more dense slips than in the cases considered by Mr. Nichols.

COMPANY REPORTS.

COPPER RANGE.

The annual report of the Copper Range Consolidated for the year 1908 shows that the Baltic Co. produced copper at a cost of less than 7¾c. per lb., a notable achievement for a Lake Superior mine recovering but 23.19 lb. of copper per ton of ore treated. The exact cost, excluding construction as an operating charge, was 7.72c., as compared with 8.75c. in 1907. Similar costs for the Champion were 8.34 and 9.05c. The copper recovery from the rock at the Baltic in 1907 was 21.94 lb. per ton; in 1908 it was 23.19. At the Champion the recovery in 1907 was 23.26, and in 1908, 22.38. Baltic's cost of $1.50 per ton of rock treated, or $1.56, including taxes, is a figure which few mines, if any, in the Lake Superior district can duplicate.

The net quick assets of the Copper Range group of properties on December 31 were $1,300,000. The Copper Range Consolidated was obliged to draw upon its surplus to the extent of $272,779 for the payment of construction and a dividend of $4 per share, the result chiefly of the low price of copper, the average for the year being 13.39c. Trimountain, while contributing practically nothing last year toward the $400,000 paid in dividends on the Copper Range shares given in exchange therefor, was able to show a surplus over construction of $41,842.

Up to the present time, or since Baltic first started as a producer in 1898, it has sent out over 107,000,000 lb. of copper. Since 1902, when the Champion mill started up, this property has produced 93,800,000 lb., while Trimountain has a record of over 59,000,000. Up to the close of 1908 Baltic has paid $45.50 per share, or $4,550,000, in dividends since 1905, while Champion since 1903 has paid $42 per share, or $4,200,000. Including $800,000 paid by Trimountain, these three South Range mines, pioneers in the territory which they have opened up, have paid their owners total dividends of $10,550,000.

UNITED STATES SMELTING, REFINING & MINING CO.

Despite low prices for metals, the above splendid company, with the superfluous amplitude of name, paid 4% on common stock, after meeting all fixed charges for the year 1908. The metals sold and prices realized were:

Metal.		Value, %.	Price, c.
Copper, lb.	32,803,603	34.5	13.27
Lead, lb.	27,304,347	10.0	4.23
Silver, oz.	8,340,566	34.5	52.97
Gold, oz.	128,206	21.0	....

These include metals from custom ores and the Mexican production. During the year the capital expenditure was increased by $996,300, distributed as follows:

Mining properties	$203,626
Smelter buildings and plant at Bingham Junction, Mammoth, and Chrome	362,619
Mills, mine buildings and other equipment	208,126
Refineries at Chrome and Graselli	71,504
Stocks in subsidiary companies and in Bullion Beck and Champion	150,425
	$996,300

From the properties in Bingham were extracted 21,487 tons, and from the Centennial Eureka 112,855 tons of ore. The output of the Mammoth mine in California was 322,003 tons, and the smelter at that point treated 436,275 tons of charge. From the Richmond-Eureka were taken 25,374 tons of low-grade ore for flux. The report gives assurance of excellent conditions as to ore reserves in all the mines mentioned, but no figures are presented. The interesting statement is made that the Buchanan mine in California, purchased during the year, bids fair to develop into a source of considerable profit, and that "there is now in sight ore enough to cover the purchase price." When mines are bought and sold on such a basis as that, the element of risk will be eliminated as far as can be from the concerns of men. It is also stated that a number of mines were investigated during the year, none of which it was deemed wise to purchase. The company definitely announces that it has "adopted an aggressive policy of investigation and extension, and a liberal appropriation has been set aside for such work." Expansion is the watchword among all the great copper producers; the leaders show no sign of skepticism regarding the future. The net earnings of the United States company for 1908 were $3,398,488, out of which dividends absorbed $2,410,783. The report is a simple business-like statement which gives the answer to the essential details that interest the great bulk of stockholders.

TONOPAH.

The seventh annual report of the Tonopah Mining Co. of Nevada shows total investments amounting to $2,509,912, an increase of $73,224 net. During the year $65,560 was charged off as depreciation, and there was a decrease of $12,746 in the amount of stocks and bonds owned. The increase was due to loans and advances to subsidiary companies. The current assets, including "net value of ore on dump, $248,349," amounted to $754,700. The combined incomes of the Tonopah Mining Co. of Nevada and the Desert Power & Mill Co., were $1,751,098, of which $750,000 was paid out in dividends and $1,001,098 carried over as surplus. W. H. Blackburn, superintendent of the mine, reports that 234,017 wet tons were hoisted from the Mizpah, Silver Top, and Red Plume shafts. Of this, 155,401 dry tons of ore, having an average value of $23.43 per ton, were shipped to the mill at Millers, 7957 tons were placed in storage, 13,635 of low-grade ore were placed on the dump, and 50,296 tons were waste rock. The mining costs were $4.60 per ton of dry ore shipped, $3.31 per dry ton hoisted, or $4.80 per dry ton of ore shipped if cost of sinking, station cutting, and diamond-drill work be included. The ore reserves March 1, 1909, are computed at 367,304 tons worth $21.11 per ton, with gold at $19 per oz. and silved at 50 cents.

A. R. Parsons, superintendent of the mill, reports an average of 93.8 stamps dropping, out of a total of 100. The dry ore crushed amounted to 158,052 tons, averaging 0.354 oz. gold and 31.13 oz. silver. From this 1504 dry tons of concentrate averaging 4.74 oz. gold, a total of 7125, and 689.46 oz. per ton, or a total of 1,036,953, of silver, were produced. By cyanidation 42,914 fine ounces of gold and 3,423,772 of silver were recovered, making an average metal recovery of 90.3%. The average price of silver for the year was 52.16c. The average direct cost per dry ton of ore milled amounted to $3.45, to which 72c. should be added for general expense. A large amount of development was accomplished.

PRESTEA BLOCK A, LTD.

This corporation owns portions of the Essarman and Intermediate concessions, in the Prestea district, near Ancobra river, Gold Coast, West Africa. The authorized capital is £500,000. The ore reserves on March 31, 1909, were estimated at 270,500 tons, having an average assay value of 11.6 dwt., and 25,000 tons, partly developed, at 12 dwt. In 1908, 89,933 tons were milled, with a gross value of £152,541. During the year several important additions were made to the plant, but owing to the flooding of the shaft, development was limited. The costs per ton in 1908 were as follows: mining, 17s. 4.64d.; milling, 10s. 5.57d.; general at mine, 3s. 1.34d.; development, 1s. 1.11d.; London expense, 1s. 2.16d.; depreciation, 2s. 7.51d.; a total of 35s. 10.33d. The value of the gold, including concentrate, recovered amounted to 34s. 5.01d. per ton. It is expected that the Government railway from Tarkwa to Prestea will reach the mine in 1909. This will reduce costs materially.

BRITISH BROKEN HILL.

The British Broken Hill Proprietory Co., Ltd., owns mines in New South Wales. The directors' report for the half-year ending December 31, 1908, tells very little about them or the year's business. The statement is made that "after allowing the usual depreciation, the half-year's expenditure amounted to £7351 17s. 0d., which has been charged to the profit and loss account, the balance of which is thereby reduced to £19,360 18s. 10d." Development amounted to 333 ft. No estimates of ore reserves are given.

Lead Production in 1908.

According to smelter returns as compiled by C. E. Siebenthal, for the U. S. Geological Survey, the lead production in 1908 was 408,523 tons, of which amount 310,762 was produced from domestic ores. The returns from refiners give slightly different figures, as shown by the following tables:

PRIMARY LEAD.

	1907.	1908.
Desilverized lead	284,432	265,564
Soft lead	99,948	101,013
Desilverized soft lead	29,809	29,856
Total primary lead	414,189	396,433
Production of antimonial lead	9,910	13,629

SECONDARY LEAD.

Pig lead	9,990	7,840
Lead in alloys	15,508	10,443
Total recovered secondary lead	25,498	18,283

The figures of domestic production are based upon returns by the smelters; all other figures are from the records of the Bureau of Statistics. Decrease by liquidation covers losses in smelting and refining in bond, and other corrections. Warehouse stocks of bonded lead of foreign origin are given, but it has been found impossible to obtain at this time complete figures of domestic stocks. For this reason the result given below is 'lead available for consumption.' The 'apparent consumption' of previous reports would be this quantity, increased or diminished by the increase or decrease of domestic stocks during the year, and also diminished by the exports of domestic lead. The domestic lead exports consist of lead in manufactures and in type, as shown below. In the following table 'lead' includes all kinds—lead in ore, base bullion, pigs, bars, and old:

Supply:	1907.	1908.
Stock in bonded warehouses January 1	5,756	12,944
Imports—		
For consumption	15,246	9,805
For warehouse	64,569	102,241
Domestic smelter production	365,166	310,762
Total supply	450,737	435,752
Withdrawn:		
Exports of foreign lead	51,447	76,357
Exports of foreign lead in manufactures under drawback	8,628	9,254
Decrease by liquidation	4,578	13,425
Stock in bonded warehouses December 31	12,944	18,565
Total withdrawn	77,597	117,601
Available for consumption	373,140	318,151

DOMESTIC EXPORTS.

Type	364	241
Lead manufactures	$686,097	$558,640

Modern Milling Plants.

Utah is rapidly making a world-wide reputation for itself by the magnificent scale upon which its more recent reduction works are being constructed. In fact, the State promises to distance all others in the magnitude of its reduction works, and especially in the line of milling and concentration. With the large plant of the Utah Copper Co. now running at full capacity, that of the Boston Consolidated, which is also nearing its intended output of 3000 tons per day, there will soon be classed the plant of the Ohio Copper Co., which is now receiving finishing touches and is situated close to the mines at Bingham. The mammoth concentrator of the Ohio Copper Co., being the latest in the field, and having had the benefit of the results and mistakes of others, promises to excel all former enterprises of this nature, especially for the reduction of the low-grade sulphides, for which Bingham is now so universally known. This plant is being built upon a liberal scale, in a most thorough and substantial manner, with concrete foundations for its buildings, as well as for all the heavy machinery, while for the building itself, a most substantial and improved type of steel construction has been adopted. It is being laid out in four units, each having a nominal capacity of 500 tons per day, and so arranged as to permit of each one being operated independently. While the general plan of arrangement and treatment is simpler and more direct than that adopted by the other works treating the same character of ore, the plant itself will be notable for the massiveness and substantial character of its reducing machinery.

Equipping this plant involved placing the largest order for crushing machinery that has ever been given in the United States, or elsewhere. The crushers will have ample capacity for fully 3000 tons per day, and they are of the latest improved Blake style. The fine-grinding is to be done by means of 7-ft. Monadnock mills, of which four machines are provided for each of the four sections of the plant, and as the capacity of each of these mills is placed conservatively at 150 tons per day, with a probability that it will reach 200, it can easily be seen that a 3000-ton capacity can appropriately be claimed for this plant. The above machinery is being supplied by the Trent Engineering & Machinery Co. of Salt Lake. It amounted to 1,600,000 lb. weight.

Commercial Paragraphs.

The MINNEAPOLIS STEEL & MACHINERY CO. has recently opened a branch office at 324 Dooly Block, Salt Lake City, Utah, which will be called the Mechanical Department, and will be in charge of O. P. Cherdron.

THE C. O. BARTLETT & SNOW CO., Cleveland, Ohio, announces that a branch office has been established at 50 Church street, New York, which will be in charge of H. H. Bighouse, chief engineer for the company.

CHALMERS & WILLIAMS, Chicago, have recently sold a five-stamp mill to M. K. Rogers, for use in Alaska; a Kennedy gyratory crusher, two sets of rolls, and 12 Frue vanners to the Bunker Hill & Sullivan M. & C. Co.; and a 3½-ft. Huntington mill plant for Cape Gracias, Nicaragua.

THE CYCLONE DRILL CO., of Orrville, Ohio, has recently made shipments to the following: E. C. Hargrave, Port Arthur, Canada; the Rio Tinto Co. for railroad construction in Spain; W. H. C. Downes, Western Australia; the Santa Rita Co., in New Mexico; Rockdale Iron Co., in Tennessee; Napier Iron Co., Tennessee; G. A. Amsinck & Co., Colombia.

Catalogues Received.

FRANK HUNTZIKER has joined VICTOR RAKOWSKY at Duluth, Minnesota, as associate mining engineer.

The WESTINGHOUSE ELECTRIC MANUFACTURING CO., Pittsburg, has just published circular No. 1502 on distributing transformers.

THE J. GEO. LEYNER ENGINEERING WORKS CO., Littleton, Colo., is distributing its Bulletins No. 1002 and 1004, which are just off the press.

The A. LESCHEN & SONS ROPE CO., St. Louis, has just published a book of views of the Lake Tramway at Chicago, which they will send to anyone interested.

The ROBINS NEW CONVEYOR CO., New York, has recently published an attractive little booklet describing its Genuine Balata belting for power transmission and conveying.

THE GOULDS MANUFACTURING CO., Seneca Falls, New York, is distributing its new power-pump catalogue, which is a 190-page, handsomely printed and illustrated book. In it are included a discussion of the principles involved in triplex pumps, many pages of useful information and tables, a complete index, and telegraphic code. No library of trade catalogues is complete without this volume.

Dividends.

On Friday, June 4, 1909, the Bunker Hill & Sullivan Mining & Concentrating Co. paid dividend No. 41 of $45,000. This makes the amount of dividends paid since January 1, $345,000, and the total to date, $11,016,000.

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EDITORIAL.

LIKE A RICHARD born with teeth, the International Smelting & Refining Co., only a few months old, promises dividends of 10 per cent on $10,000,000 of issued stock.

BOSTON signalized the acquisition of control of the Osceola mine by the Calumet & Hecla by bidding up the stock. The confidence displayed is vindicated in the results. The Osceola is producing 4800 tons of ore per diem, from which the net recovery is 17½ pounds of copper. This indicates an earning power equal to $10 per share.

FOR PRESIDENT of the American Mining Congress the name of Mr. James Douglas is being mentioned. His selection would be a particularly happy one, and would do much to strengthen the organization. It is understood that Mr. J. H. Richards, who as president has, with rare devotion and sacrifice, guided the Congress through several stormy years, desires to retire. Mr. Douglas would make an ideal successor. His broad knowledge, high character, and keen interest in public affairs makes him a powerful leader. Under his guidance the Congress might well come to be a most influential organization, guiding opinion and legislation to the advantage of every department of the mining industry.

TOPOGRAPHIC SURVEYS are of large importance to mining and engineering development. In this country they have been executed mainly by the United States Geological Survey. Beginning as a mere incident to geological mapping, they have expanded with the demand until now a complete topographic map of the country is being made. This work is too large to be done within a single generation by any one agency, and gradually the States have been brought into co-operative relations with the Federal Survey. In general the expense of the work has been divided equally, but the Federal Survey has recently been unable to accept all the help offered on the old terms, and misunderstandings and friction have resulted. Mr. George Otis Smith, the Director, has taken the matter in hand and has prepared a systematic plan for meeting co-operation. We are glad to present the details on another page. The matter is worthy of careful consideration and discussion by engineers and geologists, since it affects all parts of the country.

TRADE-SHIPS instead of battle-ships to preserve the peace of the Pacific, is the proposal of Mr. Thomas J. O'Brien, our Ambassador to Japan. Some matters, in the interest of sincerity, ought not to be discussed in public by a diplomat, and the question of national armaments is one of them. The fighting

equipment of a nation is argument enough; the foreigner knows from its strength whether it be able to protect commerce or not. If it cannot, war and reprisals are invited; if it can, then peace can be maintained. The best insurance policy upon the unobstructed expansion of commerce is a powerful navy. We do not say this in the interest of the steel manufacturers, nor of the nickel and copper producers. We merely invite Mr. O'Brien to point to any important merchant marine in the world, present or past, that has been developed without an adequate naval guarantee of protection. A brief consideration of the teachings of French and English history would save our representatives abroad from stultifying us by such post-prandial gush. To seek favor in the eyes of our rivals by such utterances is only to excite contempt.

CHINA is said to be resentful over the way the position of American minister to that country is being hawked about. This is not surprising. The administration's attitude in the matter is inexplicable. The post at Peking is in many ways one of the most important in our diplomatic service. The problems arising there are peculiarly complex and delicate. At present, principally because of our stand for the 'open door,' America is in favor at the Chinese court, and since the reformation of the consular service we have been well represented in the Empire. We are looking to the Orient for a larger commerce and for closer ties in the future. Within a few days announcement has been made that American, as well as German, French, and British, banks are to participate in financing the Hankow-Sze-Chuen railroad, and for the first time this has been brought about by the direct influence of our diplomatic representatives. This, in view of Mr. Taft's known interest in Far Eastern affairs, marks it as peculiarly strange that the position of Minister should be offered to a discredited politician such as Mr. C. W. Fulton, former Senator from Oregon, even with the explanation that it was arranged that he should decline. Since, according to report, Mr. J. A. Hemenway, ex-Senator from Indiana, Mr. John Hays Hammond, and Mr. Frederic Delano, the accomplished president of the Wabash railroad, have all had the opportunity to decline. Mr. Nelson W. Cromwell, it is stated, would have been similarly complimented, except for the danger that he would accept and that the Senate would refuse to confirm his nomination. Numerous others have been mentioned. Among the latter, Mr. J. W. Jenks, of Cornell University, is the only one who is really qualified for the position by training and actual experience in the Orient. His appointment to the Court where scholars and scholarship are especially esteemed would have much to commend it. The others are excellent gentlemen, but the appointment of any of them would be obviously in the nature of dividing political spoil. The use of so important an embassy as a means of settling accounts accumulated during a political campaign is shameless. It insults our neighbor, forfeits respect, and injures commercial relations. The position should be promptly filled by transfer of some one of the many able men in the service.

Phosphate on Public Lands.

A battle is to be fought at the next session of Congress over the conservation of phosphate resources in the United States. The question touches far more than the lands containing phosphate deposits. The amount of phosphorus exported in food products is as serious a form of loss as that involved in the exportation of fertilizers. The prevention of exportation, except as a war measure, is not permissible by our Government, and the commercial weapon of an export duty is expressly withheld by the Constitution. Restriction of the output of phosphate, therefore, would seem to be questionable as a measure of national economics. If the agricultural lands are less productive for want of fertilization the farmer will have less to sell, and prosperity will be checked. The advocates of restriction have not made it clear how that policy will improve conditions. It will dole out the treasure of phosphate stored in the hills of Wyoming, Idaho, Utah, New Mexico, and Arizona for a longer period, and the benefit, if any, would apparently accrue mainly from the wisdom that is supposed to be born of adversity. The farmer in need would learn to be a conservator in ways now lightly considered. The loss of soluble ingredients from the soil by drainage is an enormous factor in the impoverishment of the country. While not altogether preventible, methods of tillage can restrict such losses to a considerable extent, and the use of soluble fertilizers in excess, which is a cause of serious waste, can be avoided by the application of finely ground insoluble phosphates and potash minerals, which will be slowly converted to soluble forms by the acids in the soil. Thus fertility may be sustained.

The Committee on Public Lands at its hearings this spring was bombarded by suggestions. Mr. Frank Pierce, of the Department of the Interior, proposed a leasing system, permitting restrictions upon exportation and monopoly. His statement that the Department was willing to issue patents to locators of claims on phosphate lands, whether lode or placer, might be construed as representing the opinion of the Secretary of the Interior; but he suggested that the matter be referred to the courts for ultimate determination of the category to which such claims should be referred. The fact seems to be that the Department is quite ready to issue patent for phosphate claims under the placer provisions of the law, but will probably decline to take responsibility where they were located as lode-claims. A tendency was displayed on the part of some to limit the rights of those who had already located under the lode law, to the vertical bounding planes, which indicates that some have not yet learned that retroactive laws which affect vested rights are unconstitutional. Locators of claims, the character of which may be in doubt, should always take the precaution of covering the same ground with both placer and lode-locations. Application for patent can be made for either, and title to one or the other is sure to issue. Those who have in good faith located phosphate lands as lodes are in danger of losing their rights. If the courts should decide that they are placers, within the meaning of the law, there would be no remedy. It is

feasible to amend the locations, setting forth that error had been made in determining the character of the ground, and claiming title under the placer law. The courts in such case would almost certainly follow the precedent which recognizes the right of the discoverer. Mr. A. B. Browne, representing the San Francisco Chemical Company, was inclined to believe that the courts, by virtue of this spirit to uphold the first in time as the first in right, would confirm the claims of locators according to either principle. This is open to doubt.

The authority of the Department of the Interior to withdraw the phosphate lands from location is another debatable question. The courts have not passed upon it, and until they do, no one can affirm that locations made at the present time in defiance of the Executive order would not be declared valid. The law expressly sets forth the right of location upon public lands, and only an act of Congress can withdraw that right. In the case of National Parks, legislation has definitely closed those areas to location for minerals. Until a statute shall have placed the phosphate lands upon a different basis they belong to the people in compliance with the provisions of the mining law. At all events location cannot be prevented. The most that can result from the Executive order of withdrawal will be to deny applications for patent, and the right of the locator to obtain such patent can then be determined in the courts.

Tariff on Oil.

Congress has become involved in peculiar difficulties in attempting to frame an oil schedule for the tariff bill. It is found to be hard to make a revenue bill serve campaign purposes in 'trust busting' and yet keep it from hurting either trusts or independents. In the House, with great enthusiasm crude oil was put on the free list, for the avowed purpose of hurting the Standard Oil. Greatly to the astonishment of many people, the dread monopoly has continued calm and unruffled, while the 'Independents' have protested vigorously and at length, that the oil producers, rather than the Standard, would be hurt.

The Standard Oil Company is mainly in the business of transporting, refining, and marketing oil. It produces relatively little 'crude'. After reading the recent literature on the subject, it will surprise many to be told that the oil business is one of those in which the small capitalist has now the freest opportunity. It costs but little to take up leases and to put down a few wells, and if oil in quantity be found, the Standard can be depended upon to take the product at the well and to pay cash. The market is assured, and not even ore is so salable. Many men have become rich by finding oilfields and selling their output to the Standard. The policy of the Company has seemed to be to encourage the finding of new fields, and to restrain production in the old ones. When the many peculiarities of oil occurrence, and the great waste involved in the sudden production of immense quantities of petroleum in new territory, is taken into account, a rational basis for this policy is apparent. The limits of the field being once known, it is better to hold the oil in the ground than to bring it to the surface, with consequent loss by leakage, evaporation, and interest charges. Markets grow with population and industry, but oil-production increases by no known or regular law. There are many evidences that supply and demand do not fix the price of American oil, and this is perhaps as often a blessing as a hardship.

There is always the menace, and often the realization, of a sudden and large production of 'crude' from a new field. A few years ago it was Texas and the Gulf Coast, then California, Oklahoma, Illinois, and now it is Mexico. The Gulf Coast is still potential dynamite, and from many other quarters sudden and disturbing production may come. This is a natural risk of the business. Mexican oil is feared only as it may develop—not as it has so far become a factor in the market. A tariff is asked to permit an easier adjustment of industry in the event that the Mexican fields should furnish a large quantity of cheap 'crude' at tidewater. The Standard could use this to advantage. The independent refiners could not. This would enable it the better to undersell the smaller refiners, and at the same time would reduce the amount of oil taken from domestic producers. It is probable, though by no means certain, that prices of crude oil would be locally reduced. At any rate, the reduction in the percentage of production taken would reduce the immediate value of leases. That would make easier the gathering in of proved production, which is now apparently a part of the Standard's policy. Our own resources would be conserved, and cheap foreign raw materials would be manufactured here to be sold abroad at a material advance in price. Economically this is all to our advantage, with the single exception that the hold of the monopoly on the oil industry would seemingly be strengthened. It is well to remember, however, that Mexican oil is of low grade, and is mainly valuable for fuel. Great quantities can be absorbed in Mexico, as are similar quantities of California oil on the Pacific Coast, in doing work elsewhere done by coal. Neither Mexican nor Californian 'crude' is high in the lighter oils. Indeed high-grade East Indian oil is now imported into California for refining. If large quantities of oil suitable for refining be found in Mexico, the discovery will materially affect the world's markets. Every time we refuse to take Mexico's freely offered raw materials, we stimulate her own manufacturing industries. Shall we refine Mexican oil here, or shall it be refined in Mexico at perhaps lower cost and meet our own oil in competition abroad? It is only a choice of where we will meet competition.

These difficulties in the attempt to frame a tariff law in the way it is now being done, illustrate the fact, we believe, that the problem of control of monopolies must in any event be fought out squarely as a separate issue. It is overworking the tariff idea to make it hit the trusts, protect home industry, and provide revenue, all at one time. The 'shot-gun prescription' of the old blood-letting school of physicians has been superseded by more intelligent therapeutics. It were time that we apply higher wisdom to the tariff, and make it serve its purpose in a direct way, or create a commission to adjust it in accordance with the needs of trade and revenue.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

WM. BAYLEY, Jr., is at Paris.

W. S. NOYES is at Shafter, Texas.

C. C. BRACKEN is at Mocorito, Mexico.

L. W. POWELL has been in Los Angeles.

R. G. HANFORD has returned from the East.

C. W. PURINGTON was in Yokohama May 30.

SEELEY W. MUDD has been at Kelvin, Arizona.

WILBUR A. HENDRYX of Denver is at New York.

HOWARD D. SMITH has gone to Oroville, California.

J. D. IRVING has gone to Nevada for the summer.

BARON MANNERHEIM, of Sweden, was in San Francisco.

E. N. LOWE has been appointed State Geologist of Mississippi.

F. LYNWOOD GARRISON has gone to Arizona from Silverton, Colorado.

O. H. FAIRCHILD is in Arizona examining properties for Eastern interests.

P. H. REARDON, of the Compressed Air Machinery Co., San Francisco, is at New York.

DWIGHT E. WOODBRIDGE was in San Francisco and has gone to Steeplerock, New Mexico.

J. MORGAN CLEMENTS has moved from 15 William street to Suite 1707, 42 Broadway, New York.

A. V. JUDSON, mill superintendent for the Soledad Mining Co., at Mojave, California, is in San Francisco.

HENRY F. LEFEVRE has returned to New York after a three months absence examining mines in Central America.

F. L. RANSOME, assisted by E. S. BASTIN, will study the Breckenridge, Colorado, district this season for the U. S. Geological Survey.

A. F. CRIDER has resigned as State Geologist of Mississippi, to go with the Bishop's Alabama Marble Co., at Talladega Springs, Alabama.

RALPH ARNOLD has opened an office for consulting work in the H. W. Hellman building at Los Angeles. He will devote especial attention to oil.

H. G. GILKERSON, of Telluride, Cripple Creek, and Goldfield, has recently opened an office as a mining and civil engineer in the Judge building, Salt Lake, Utah.

ALLAN GIBB has sailed from London for South Africa, where he will proceed to erect a dressing and smelting plant at the Star of the Congo copper mine, belonging to the Tanganyika Concessions, Ltd.

J. G. LAWN, who has for two years been professor of mining at the Camborne School of Mines, is returning to the Transvaal, where he will succeed Professor Orr as professor of mining at Johannesburg.

THE UNIVERSITY OF MISSOURI SCHOOL OF MINES, at Rolla, held its thirty-eighth annual commencement June 9. Thirty-two engineering degrees were conferred, and eleven in general science.

Obituary.

NORMAN COOKSON died at Newcastle on Tyne, England, recently. He was head of the firm of Cookson & Co., noted for its brand of antimony, also lead smelters and desilverizers. He was noted as a collector and grower of orchids, his collection being probably unsurpassed.

ERNEST L. FRALECK, superintendent of the Cobalt Lake mine, died of typhoid on May 27, at the age of 33 years. He was a graduate of the Kingston School of Mines, and was regarded as one of the ablest mining engineers in the camp. He was for some time connected with the Canadian Geological Survey and did much to attract interest to Cobalt.

Latest Market Reports.

LOCAL METAL PRICES.
San Francisco, June 17.

Antimony	12—12¾c	Quicksilver (flask)	44—45
Electrolytic Copper	15¼—16½c	Spelter	6½—7¼c
Pig Lead	4.60—5.55c	Tin	32—33½c

ANGLO-AMERICAN SHARES.
Cabled from London.

	June 10. £ s. d.	June 17. £ s. d.
Camp Bird	1 6 6	1 9 9
El Oro	1 6 3	1 6 3
Esperanza	2 18 9	2 16 3
Dolores	1 10 0	1 10 0
Oroville Dredging	0 13 0	0 13 0
Mexico Mines	6 6 0	6 0 0
Tomboy	1 2 6	1 2 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.
By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 11	13.44	4.35	5.39	52⅝
" 12	13.38	4.35	5.40	52⅝
" 13	Sunday.	No market		
" 14	13 38	4 35	5.43	52⅜
" 15	13.32	4.35	5.43	52¼
" 16	13.25	4.35	5.43	52⅜
" 17	13.25	4.35	5.43	52⅜

MINING QUOTATIONS—NEW YORK.

	Closing Prices. June 10.	June 17.
Amalgamated Copper	86¼	80¾
American Smelting & Refining Co	95⅜	90
Boston Copper	15¾	14½
Butte Coalition	26¾	25½
Cumberland-Ely	7½	8
Dolores	4¾	5
El Rayo	2¼	2⅛
Giroux	7½	7½
Greene-Cananea	10⅝	10⅝
Indiana Sonora	3⅛	3
La Rose	7½	7⅞
Miami Copper	15	16
Nevada Consolidated	22⅝	22⅞
Newhouse	2	1⅝
Nipissing	10⅝	10⅝
Ohio Copper	4⅞	4⅜
Tennessee Copper	41½	39½
Utah Copper	52¾	50½
Yukon	4¾	4⅝

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

SOUTHERN NEVADA STOCKS.
San Francisco, June 17.

Atlanta	$ 15	Mayflower	$ 9
Belmont	81	Midway	21
Booth	13	Montana Tonopah	65
Columbia Mtn	11	Nevada Hills	1.00
Combination Fraction	60	Ophir (Comstock)	1.35
Daisy	29	Pittsburg Silver Peak	50
Fairview Eagle	20	Rawhide Coalition	27
Florence	3.07	Rawhide Queen	32
Goldfield Con	7.55	Round Mountain	64
Gold Kewenas	11	Sandstorm	10
Great Bend	6	Silver Pick	12
Jim Butler	13	St. Ives	11
Jumbo Extension	13	Tonopah Extension	53
Llanos Con	75	Tonopah of Nevada	7.00
MacNamara	26	West End	24

L. VOGELSTEIN & Co. report the German consumption of foreign copper during the months January-April, 1909, as follows:

	Tons.
Imports of copper	49,323
Exports of copper	2,703
Consumption of copper	46,620

Of the above quantity, 45,026 tons were imported from the United States. The consumption during the same period in 1908 was 53,810 tons.

Alaska's growing interests are not to be forgotten by this Congress, if the present activity toward new legislation is any sign. James Wickersham, of Fairbanks, Alaska, delegate from that Territory, has come forward with a bill providing for the creation of a general assembly with the proper legislative powers, and one providing for mine inspection and inspectors. The latter bill provides for the appointment of four mining inspectors, at a salary of $3000 each, and for making the Governor ex-officio chief mining inspector.

General Mining News.

ARIZONA.

COCHISE COUNTY.

Sulphide ore has been cut by a 65-ft. drift on the 1200-ft. level of the Denn.——The shaft of the Heffern is down 450 ft., and the company plans to cross-cut from this point. Albert Heffern is in charge of the work.

GILA COUNTY.

The Live Oak vertical shaft, which is down to a depth of 245 ft., has been in ore for the last 45 ft., that averages 3% copper.——A raise from the Gem vein on the Globe Consolidated property shows 2½ ft. of 13% copper ore. A carload of ore recently shipped to the Old Dominion smelter ran 5% copper, 35% iron, and the same amount of sulphur. Gold and silver to the extent of $2 per ton was also shown.

Most of the work of blocking out ore, and of driving and cross-cutting on the orebody at Miami is being done in shaft No. 2 at a depth of 570 ft. A new shaft, called shaft No. 4, is being sunk and will eventually be the main one from which most of the ore will be taken, when the machinery is in place. A force of 50 men is now at work on the 350-ft. level, and between 60 and 70 tons of ore is being shipped daily. The returns from this ore are about 12%.——The Inspiration is sinking two shafts and running three tunnels to block out the orebody. The Bulldog shaft is down 310 ft. and the Joe Bush 235 ft. Both have cut sulphide ore. John D. Coplen is manager.——Work at the 330-ft. level of the Keystone has been stopped until a station is cut at 150 ft.——From 10 to 15 tons of 20% ore is being shipped per day by the Gibson Copper Co. The ore is being stoped on the 400-ft. and development carried forward on the 500 and 600-ft. levels. S. L. Gibson is superintendent.——The Arizona Commercial Copper Co. expects to have its 400-ton smelter ready for operation about August 15.

GRAHAM COUNTY.

At a special meeting of the Shannon Copper Co. it was voted to increase the capital stock from $3,000,000 to $3,300,000 by adding 30,000 shares par value $10 each.

YUMA COUNTY.

The finding of oil in an old shaft near Tacna has caused a rush to that district and a large number of claims have been staked.

CALIFORNIA.

BUTTE COUNTY.

It is officially announced that the Big Blue Lead mine will resume operations on July 15. Development work has been continued with a small crew for several months and a quantity of gravel running $3.50 to $4 per yard has been blocked out. W. Lambert is superintendent.——The Natoma Consolidated Co. has purchased the dredges and lands of the Feather River Development Co. and is moving the shops from Dredgeville to Marysville.——The Magalia Ridge Consolidated Mines Co. is arranging for extensive work at the Durgin and Gunn properties.——The Mammoth Channel Gold Mining Co. is awaiting the shipment of a new hoisting plant for the 200-ft. two-compartment shaft. Upon its installation three shifts will be put to work. Large quantities of pay gravel are blocked out in the shaft and the 1255-ft. tunnel.——The Cape Horn Co. is blocking out gravel. Owing to lack of water no production is going on.——The Butte Creek dredge is working downstream and handling about 150,000 cu. yd. of gravel per month. It is reported that the company is contemplating the installation of a second dredge before the end of the year.——The Cohn & Gooday Co. is developing promising gravel in its property on the Cohn ranch. It adjoins the Cape Horn mine.

ELDORADO COUNTY.

The Wizard mine, which has been idle for several years, is to be unwatered and re-opened. D. L. Shepherd is in charge of the work.

INYO COUNTY.

The tramway of the Four Metals Mining Co. is handling 150 tons of ore per day from the Cerro Gordo mine to the smelter at Keeler. The plant was stopped for a few days to clean out the furnace which froze when the company attempted to smelt some copper ore. The furnace will be run on a lead-silver ore in the future.

NEVADA COUNTY.

Operations have started on the McDonald ranch on the slope of Banner mountain to strike the gravel channel which crosses the property. A new shaft is being sunk and the company expects to reach the channel at a depth of 250 ft., on the incline.——The Hartery mine will probably be reopened by S. H. Dille.——Lessees in the Providence mine have broken into the foot-wall vein. This carries free gold and sulphides.——In the Home a raise is being driven to cut the Wyoming vein.——The shaft at the Oustomah has been sunk over 900 ft. Some excellent assays have been made from the ore and it is estimated that the shoot will average $40 per ton. Ten stamps are dropping at the mill.——The Brunswick Mining Co. has purchased five acres of ground for a surface plant and will start sinking at once.

The Brunswick Mining Co. has closed a deal for five acres of the Matteson ranch and will immediately commence the sinking of a three-compartment 1000-ft. vertical shaft. C. A. Mallen is superintendent.——It is reported that a large pocket of bonanza ore was recently encountered in the Empire.——The 10-stamp Lecompton mill is running on ore from the upper workings. The pumps are steadily lowering the water in the shaft and sinking will soon be resumed.——The Prescott Hill shaft is being sunk 500 ft. from the 1300-ft. level. The mill is running on fair-grade ore from the 600-ft. and lower levels.——Fifty lessees are operating in the Champion and 27 men are employed by the company. At the mill 30 stamps are dropping.——A shaft is being sunk at the McDonald mine to cut the old gravel channel. It is down about 20 ft., and is expected to strike the channel at a depth of 250 ft. S. H. Dille is superintendent.——A small force of men is working at the Woodberry and have opened a small streak of good ore.——The gravel channel at the Posey Canyon continues to show up well and the management expects to install additional machinery at an early date.——At the Jenny Lind a small force is driving the adit. Some fair-grade gravel has been found, but the property has not come up to expectations.

PLACER COUNTY.

At the Dewey mine, under bond to Wood & Parker, a strike of high-grade ore has been made. The shaft cut a vein of 'picture rock' at a depth of 52 ft.——The Kavanaugh Co. has struck gravel in the Placer Queen and run 300 ft. across from the western rim, but has not yet found the eastern rim. The gravel is of a bluish-gray cast and carries gold. The mine is situated between Soda Springs and Robinson's Flat.——The El Dorado-Placer Dredger Co. has decided to build another dredge at the Cash Rock in place of the one swept away by the flood last winter. The new dredge will be a bucket and suction combination.——Rich ore has been cut on the 400-ft. level of the Crater mine.——The Nevada mine near Ophir is to be re-opened by L. B. Butts.

SIERRA COUNTY.

The Brush Creek mine near Mountain House is to be reopened. A new shaft will be sunk with stations every 150 ft., and a mill with a daily capacity of 150 tons constructed when sufficient ore has been blocked out. The old shaft is down 749 ft., cutting a 10-ft. vein between walls of serpentine and granite.

Twenty men are at work at the Willoughby mine above Gold valley. The mill is expected to start up shortly.——George P. Moore has a bond on the Southworth property in Slate Castle ravine.——The Glidden mine near Gold lake has been bonded to San Francisco parties.——The Gold Ridge gravel mine will be opened next month. This mine was previously worked as a hydraulic proposition, but will now be operated as a drift mine.——An adit is being driven to tap the gravel channel of the Hilda mine.——At the Sierra Buttes mill 20 stamps are dropping, and 40 men are working in the mine.——The Keystone mine is being worked by several sets of lessees through an adit 1⅛ miles long.

TRINITY COUNTY.

Wilson and Ehrmann, who have a two-year lease on the Nob mine, have cut a 16-in. vein. This will be shipped to the smelter, as it assays over $500 per ton.——The Trinity River Mining Co. is making extensive preparations for its summer's work in mining the bed of the river above Lewiston. San Francisco engineers are installing an electric plant with 1800 hp. This will develop power for elevators and other machinery.——Paulsen Bros., Richards & Newlands have a lease on the Jacobs mine in Eastman gulch, and they are taking out good ore, which will be shipped to the Selby smelter.——The Lappin mine, at Deadwood is developing some good milling ore. A gasoline engine is to be installed for power to run the mill.——A vein from 12 to 18 in. wide has been cut in the Leas & Nicholson mine under bond to the West Point Mining Co. The ore mills from $50 to $60 per ton.——The cross-cut from the 120-ft. level of the Hoodoo mine cut a 3-ft. vein of milling ore.——The Blue Jacket mine cut a 2-ft. vein of ore.——A high-grade bench placer mine has been found above Waldorff crossing, on the North Fork, by J. E. Given.

TUOLUMNE COUNTY.

Ten stamps are being added to the Omega mill to handle the increased output from the mine.——A large boiler and pump have been placed at the No. 2 shaft of the Gold Ship mine near Groveland.——The machinery at the Cosmopolite mine has been sold to a company operating a property near Bull creek.

COLORADO.

GILPIN COUNTY.

Two hundred dollars per ton was the smelter return on a shipment of ore from the Alps mine.——A gasoline hoist has been installed at the Poole shaft of the Gilpin-Boulder Consolidated Mines Co. E. H. Crabtree is in charge of operations.——Work has been stopped on the Ridge mine in the Russell district till the company can install heavier machinery.——The Daisy mill in Gamble gulch is being overhauled by Burnell & Gearan to crush the ore from their Free Gold mine near Perigo.——The Lillian, Federal, and Hughes mines in the Russell district have been bonded to Eastern capitalists.

GUNNISON COUNTY.

The property of C. C. Brunner on Galena mountain will commence shipping lead ore to the smelter at an early date. ——There are two shifts at work in the adit of the Mountain King mine.

LAKE COUNTY.

About 50 tons of high-grade ore has been taken out of the recent strike on the Tribune property and will be shipped to the smelter. A sample from the present working face assayed 9 oz. gold, 30 oz. silver, 3% lead, and 3% zinc. L. R. Johnston is manager.——On the Tucson mine of the Iron Silver Mining Co. a double-drum hoist to be operated with electricity is being installed. It is expected that this work will be completed during the next few weeks.——A new hoist is also being placed in the Vinnie property of the Golden Eagle Mining Co., which is working under the management of a set of lessees through the Yak tunnel.—Al Ganz and associates have secured a lease on the Progressive property north of Fryer hill. The shaft is 800 ft. deep, and lateral work will be carried forward from that point. C. W. Rogers is in charge of the work.——The Castle View mine on Carbonate hill is shipping about 25 tons of iron ore per day to the smelter.

SAN JUAN COUNTY.

The Allis-Chalmers Co. is to furnish the Intersection Mining Co. with a 5-stamp mill. A larger mill will be erected as soon as the complete treatment has been determined.——J. B. Ross, holding a lease and bond on the Silver Ledge mine near Chattanooga, has started active work on that property. The mine is equipped with a 200-ton mill.——The second dividend of 20% on the stock of the Iowa-Tiger Leasing Co. was paid on June 15. The company is shipping ore and concentrate.

SUMMIT COUNTY.

The concentrate from the Wellington amounts to two or three cars per day.——One car per day of high-grade zinc ore is being shipped by the Country Boy.

TELLER COUNTY.

A dividend of 1c. per share was declared by the Granite Gold Mining Co.——An important surface discovery has been made on the south end of the Nightingale lode mining claim on Raven hill, by Milhoan & Mart, lessees from the Stratton estate, and ore running as high as 5 oz. gold per ton is being saved for shipment. At the depth of 30 ft. the vein fills the bottom of the shaft and is all of a shipping grade.——A carload of 4-oz. ore was billed out from the Lucky Gus No. 2 by Moore and associates, lessees on that Stratton estate property. The ore was mined from the main Lucky Gus vein at the 400-ft. level of this Bull hill property. ——On a recent shipment of ore from the Mountain Beauty the return was $24 per ton. The lessees are following a new vein intersected by a cross-cut south of the shaft.——The Isabelle mill is treating 125 tons of $2 ore per day. The monthly clean-up amounts to about $7000.——A rich ore-shoot is reported entered on the Victor Gold Mining Co.'s Thomas fraction, where the lessees, Milhoan & Mart, are sinking on the main Victor vein, at a point southeast of the old workings.——The South Burns Mining Co., operating on the South Burns mine of the Acacia Gold Mining Co., has cut an ore-shoot at the tenth level. This has produced several cars of ore on which the return has been from $30 to $40 per ton, and a good grade of ore is also showing in the bottom of the shaft.——A new ore-shoot on the Gold King vein has been opened on the northeast corner of the E. Porter Gold King mine on Gold hill. H. J. Anstie is manager.

IDAHO.

BLAINE COUNTY.

A 75-ft. drift has been run along the vein recently cut by the adit on the War Dance property. A small seam of ore was followed and a number of pockets found.

IDAHO COUNTY.

The Chilean mill at the Twin Butte mine has been so successful in crushing the ore that another one will be installed. The mill is grinding 125 tons of ore per day to 40 mesh.——The Thunder Mountain Mining Co. is to prospect its ground with a diamond-drill from the adit level.——A large body of free-milling ore is opened on the 250-ft. level of the International mine. D. Miloradovich is manager.—— Three feet of lead ore has been cut on the Saradoc property south of the Dixie by the 140-ft. adit at a depth of 75 ft.—— A 7-ft. vein was cut by the 400-ft. adit of the Golden Crown mine. J. R. Painter has a bond on the property.——The Buster mine has cut a good vein of ore.

KOOTENAI COUNTY.

The Spirit Lake Mining & Milling Co. cut copper ore in the face of its 103-ft. adit. A contract for 250-ft. of work in its lower adit is to be let.

SHOSHONE COUNTY.

Leo Greenough, manager for the Snowstorm Mining Co. at Mullan, announces that the shipments of ore for May amounted to 10,000 tons. The Garfield smelter at Salt Lake City and Balaklala smelter at Kennett have contracted for the ore.——The Caledonia Mining Co., operating near Wardner, is shipping 6 cars of ore to the smelter this month. This is being mined on the 300-ft. level. The shaft has been sunk to the 500-ft. level, and a skip-pocket is now being put in, after which cross-cutting for the vein will be begun.—— Three cents per share dividend has been declared by the directors of the Snowstorm Mining Co., operating in the Couer d'Alene. The fiscal year will close June 30. For the 12 months the company has declared seven dividends, with the present one, six of $45,000, and one of $60,000.——William Squance and associates are opening the Bullion copper mine. The ore is chalcopyrite carrying some silver, and is about 30 ft. wide.——The annual report of the Blue Bell Mining Co. stated that 650 ft. of cross-cuts and drifts has been run, exposing a vein of lead and zinc carbonate. To get vertically under the outcrop will require 800 ft. more work, and this will give 1500 ft. backs.——The Jack Waite property on Tributary creek is to be opened shortly.

KANSAS.

CHEROKEE COUNTY.

A new mill, the Edith T., has been recently put into commission by the Lotawanna Co. The ore has been developed at 125 ft., occurring in a 70-ft. face running 10%, and is mostly zinc-blende with a slight mixture of galena. The plant is a double one, and only one side has as yet begun operation. The trial run has been made successfully.——A Council Grove group of men has developed a new mine on the Murphy land in Short Creek bottoms. The ore is found at 91 ft. with a face 12 ft. high.——Many sub-lessees are at work on the Short Creek land since the unwatering, and most of these are finding good ore.——The Oklahoma Mining Co. at Baxter Springs is putting shaft No. 2 into commission and is installing the necessary machinery. A rich deposit of ore has been found in sinking the mill shaft deeper and the stope will be taken up.

MISSOURI.

JASPER COUNTY.

The feature in this district is the reviving of old properties. The Huron Mining Co. is now operating on the old Pearl C. tract from three shafts. A number of drifts have been run at the 125-ft. level, part encountering good zinc-blende and part rich silicate. The old mill on the land has been overhauled for present operation.——The Barfet Mining Co. is working the old Cardinal tract, having run drifts above the former timbers and a good tonnage of ore is being taken out. The ore is treated on a battery of hand-jigs.——Two new sludge plants are at work in the camp, the A. W. Grannis plant on the tailing accumulated from the custom mill near the Frisco railroad and the mill recently built on the Kalitan ground.——To the east of Sucker Flats the Alben tract is the scene of a strike at 210 ft., continuing to 246 ft. Contrary to the usual conditions in this district the zinc ore is found on top and the galena below.——The Newsboy mine has been re-opened and a mill of 150 tons daily capacity completed.——The Missouri Mule is being opened north of Webb City, the same run being found which is worked on the Red Dog adjoining. A shaft is being put down north of the old mill and an inclined tramway is to be built.——In the same camp the White Dog has found a run of sheet lead 6 ft. thick below the former drifts.——Several mills are ready to operate on ore from leases in the sheet-ground camp west of Joplin.——M. G. Esterbrook is making improvements at the Rabbit Foot mine in Central City to work a body of 4% ore.

NEWTON COUNTY.

In the Little Boss at Granby a 20-ft. face of rich silicate and lead with a small percentage of zinc-blende has been opened.——On the same land Goade Bros. have developed a lease until a mill is needed.——The old Delta mine at Spring City is to be re-opened by a new company, as the former one forfeited the lease. A new shaft is being sunk to the deposit which will also provide better ventilation, and plans are also under way for the building of a larger and more modern mill.——In the same camp to the east of the lake the Microbe Mining Co. is erecting the old Dutch Mike mill moved from the Blendville camp.

MONTANA.

FLATHEAD COUNTY.

The Silver Crown Mining Co., operating a group of claims on Granite creek, 10 miles from Libby, has shipped 18 tons of silver, lead, and gold ore to the Tacoma smelter.

GALLATIN COUNTY.

A fire at Storrs, 12 miles east of Bozeman, completely destroyed the coal washer of the Washoe Copper Co.'s plant. The plant and mines were recently leased to J. P. Reins, of Butte.

NEVADA.

ESMERALDA COUNTY.

The shaft of the Nancy Donaldson is down 80 ft. and the company has installed a hoist for deeper sinking and lateral development.——The framework for the plant of the National Ore & Purchasing & Reduction Co. at Rawhide is nearly completed. Many lessees are holding their ore to save transportation expenses.

HUMBOLDT COUNTY.

The Florence lease on the property of the Seven Troughs Mining Co. cut a vein of copper sulphide carrying a high percentage of silver in their 200-ft. cross-cut from the shaft.

NYE COUNTY.

The shaft on the Rickard-Garberg lease is down to the 275-ft. mark. In the lateral work at the 160-ft. level 30 ft. of vein matter has been proved in place, some 4 ft. of this assaying $25 or $30 per ton.——The Pioneer Leasing Co., of Rhyolite, announce that they will pay their first dividend, probably 5c. per share, before the end of this month. ——The Montgomery-Shoshone has 5000 tons of high-grade ore opened on the 500-ft. level.——The Tonopah Extension Mining Co. has broken ground on its mill-site. The mill is to have 30 stamps.——The Jefferson Mining Co. cut a body of ore in a 70-ft. winze that assays 7000 oz. silver per ton.

Three hundred men are working at Pioneer. Fifteen gasoline and two electric hoists are in commission.——In the Tex Rickard property a stringer of ore about 4 in. wide has been struck near the 200-ft. level, that carries ore assaying $400 per ton. About 500 sacks have been extracted. A drift is being driven from the 200-ft. level to develop the shoot.——The Pioneer lease has installed an electric hoist at the 215-ft. point in an 80-ft. winze. A carload of ore valued at $12,000 was recently extracted at this level and shipped to Goldfield. The lease is shipping at the rate of



Hooligan Hill, Rawhide.

90 tons per day.——The Engineers lease on Pioneer has a shaft down 100 ft. and is installing a double-drum electric hoist. Three shifts are working. A 20-ft. vein of milling ore has been cut by the shaft.——The shaft at the Savage lease is down 145 ft. and a 15-ft. cross-cut has uncovered a vein of $12 ore.——The Mayflower mill is operating steadily on good-grade ore. The May clean-up amounted to $12,000. ——The Jefferson mill at Round Mountain has been completed and the plant will be placed in commission within two or three weeks. It is expected that its operation will result in the working of several mines in the district that are now idle owing to lack of milling facilities.——Owing to a war over the water-right between the Daisy and Hydraulic companies, the pipe-line company has refused to carry the water for the two mills. As a result the Daisy and Sphinx mills are closed. In order to avoid extended litigation the Daisy Co. is arranging to construct its own pipe-line.——The Round Mountain Co. has struck a pocket of remarkably rich ore. Several large nuggets have been extracted.——The Johnnie Mining & Milling Co. is producing at the rate of $15,000 per month. P. E. Mitchell is manager.——The placer mining excitement continues and a majority of the claims are making good. In many cases the unusually high costs of working the properties materially offsets the richness of the gravel.

WHITE PINE COUNTY.

The Success mine at Ely is being unwatered and will commence shipping to the Salt Lake smelter.

NEW MEXICO.

LINCOLN COUNTY.

M. Wertman, who has a group of six claims in Oscuro district, is driving a tunnel on the Copper Foothill lode and is now in 300 ft. on a vein of copper ore which also carries silver and lead. In drilling for water on the outskirts of the district Robert Ross and S. W. Whitmire passed through 4 ft. of coal at 60 feet.

OTERO COUNTY.

J. C. Dunn, who has a group of five claims three miles from Alamogordo, is down 100 ft. and has 6 ft. of $12 gold ore.——A force of 60 men is at work on the Bent property on Tularosa creek. The mill is to be added to and the property worked on a larger scale.——The new sampling ore-bins at the Orogrande Smelting works are now completed and the ore crusher has been put in place. The carriers are being installed and connections made which will make this one of the best sampling plants in the territory. When completed the plant will be able to take care of two cars per hour. No definite date has been set for blowing in the smelter, but men are now out buying ores which are to be brought in as soon as the sampling plant is ready and the bins will be filled up.——G. E. Moffett and associates have resumed work on the Monarch and are now making a raise from the main drift from the 200-ft. level for the purpose of intersecting an old winze made from the 100-ft. level.——The Treasure Mining Co. is taking out some high-grade silver and copper ore.

SOCORRO COUNTY.

The Kelly mine is now in active operation, the present output being 35 to 40 tons of sulphide ore per day, which


TAOS
COLFAX
SAN JUAN
RIO ARRIBA
UNION
MORA
MC KINLEY
SANDOVAL
SANTA FE
SAN MIGUEL
VALENCIA
GUADALUPE
QUAY
N E W M E X I C O
ROOSEVELT
S O C O R R O
LINCOLN
SIERRA
CHAVES
GRANT
OTERO
EDDY
LUNA
T E X A S
M E X I C O
Gallup
Las Vegas
Albuquerque
Los Lunas
Socorro
Tularosa
Alamogordo
Silver City
Deming
Las Cruces
El Paso
Carlsbad
Roswell
Lincoln
Tierra Amarilla
Clayton
Raton
Bernalillo
Terrero
Magdalena
San Marcial
Hillsboro
Lordsburg
Pecos
Rio Grande
Rio Grande
Rio Grande

Mining Co. has made excellent progress at the Belcher mine. The tramway from the mine to the ore-bins at the head of the Belcher Mountain railway has been completed, enabling the landing of six tons of ore to the bins, over a double track, every five minutes. A raise has been put up from the No. 3 adit level toward the No. 2, 80 ft. in ore. Another raise has been put up from the No. 2 adit level 145 ft., the last 30 ft. being in carbonate ore, carrying some gold and assaying about 40% iron. It is estimated that the body is 60 ft. wide and contains about 40,000 tons. The repairs to the Belcher Mountain railway have been completed, and 40 tons of iron sulphide ore has been shipped to the Granby smelter at Grand Forks, B. C., and 20 tons of carbonate ore to the Trail smelter at Trail, B. C. Bruce White is in charge of the work.

OKANOGAN COUNTY.

Arrangements are in hand for the building of a mill at the Ruby mine, at the base of Mt. Chopaca, near Nighthawk, for the purpose of introducing an electro-chlorination process. The development of the Ruby mine is such that an unlimited quantity of medium and low-grade ore has been exposed. The mine has produced considerable high-grade ore, the shipping returns being over $300 per ton and paying nearly all the expenses of opening the mine.——The workings of the Golden Chariot mine, on Kruger mountain, have reached a vertical depth of 200 ft., and a drift is being driven on a 6-ft. vein, following a pay-streak from 8 to 18 in. wide. Two carloads of ore have been shipped to the smelter. ——The face of the long bore of the Palmer Mountain Tunnel & Power Co., on Palmer mountain, shows a change in the formation; the rock is softer and water is flowing in freely. A small stringer of quartz shows strong indications of copper.——Work has been resumed on the Rainbow group, on Copper mountain, in Meyers Creek district. New living quarters are to be erected and the extraction of ore for shipment started when the wagon-road is completed. The group consists of the Rainbow, Texas, and Mexico claims, which have been opened by 540 ft. of adits and drifts and about 150 ft. of shaft work. The ore yields copper and gold.—— Ore is being mined and milled at the Poland-China mine.

STEVENS COUNTY.

The Border Mining & Milling Co. has contracted with the Kettle River Lumber Co. for a tract of land adjoining the Beecher townsite, and has also contracted for the purchase of 350,000 shares of the stock of the Beecher Gold Mining Co.——The double-compartment shaft on the Second Thought mine is down 50 ft. and has cut a vein between well defined walls.——The adit on the Trojan mine is in about 550 ft. and has intersected 10 ft. of vein material, separated by talc from the walls. The foot-wall is of andesite and the hanging of granodiorite. A drift will be started on the vein, and the adit will be extended about 200 ft. farther to cut the main vein. The face at present is at a vertical depth of about 400 ft.——The Michigan Mining Co. has encountered ore in the adit on the Chicamun claim which assays from $120 to $140 in gold per ton.——A new strike of galena and chalcopyrite has been made in the Easter Sunday mine at a depth of about 25 feet.

The Arlington mine at Ruby has resumed operations. The mine is developed by a shaft and a cross-cut to the 200-ft. level, and on that level drifts were run on the vein for about 700 feet.

WYOMING.

UINTA COUNTY.

A new oil district has been opened near Kemmerer near the Oregon Short Line. Two California companies are operating there at present, the Fresno-Wyoming and Fresno-Uinta Oil companies. All the available land around Kemmerer for miles has been located and all of the companies operating in the field have large holdings in that locality.

CANADA.

BRITISH COLUMBIA.

The largest copper-furnace in the Dominion of Canada, 42 in. by 25 ft., was blown in by the Consolidated Mining & Smelting Co., at its Trail smelter in the early part of this month. This gives the company four large copper-furnaces, with a capacity of 1800 tons per day. Mechanical feeders are being installed on the large lead-furnace. This makes as high as 98 tons of bullion in 24 hours and the refinery is producing as high as 75 tons of pure lead per day. The Consolidated company has taken a bond on the Alice mine near Creston.——The Dominion Copper mines at Phoenix have been purchased by Charles Hayden, of New York, for $261,500.——The latest strike on the Golden Belle mine at Sheep Creek has shown an assay value from a large sample of $10.25 per ton. The Kootenay Belle mill and mine at this camp is again under operation by J. L. Warner and his associates.——The Granby Co. is making arrangements to start work on its Gold Drop property in Phoenix camp, secured several months ago. The mine is virtually a quarry, and will employ between 150 and 200 miners.

The Blue Bird mine shipped 30 tons of rich ore during the past week, while the Centre Star group and the Le Roi No. 2, Ltd., sent average shipments to the Trail smelter. It is rumored that work will be resumed at the Le Roi shortly.

ONTARIO.

The Beaver Consolidated Co. cut two veins of calcite and quartz with their diamond-drill.——On the Peterson Lake lease of the Little Nipissing a good ore-shoot has just been cut in the raise from the 160-ft. to the 100-ft. level. The vein is 4 to 8 in. wide of 3000 to 4000 oz.——The Wettlaufer, of the South Lorrain district, has started their new 6-drill compressor. The development work at this mine has paid for the equipment. Frank C. Loring is consulting engineer.——A 5-in. vein of calcite, cobalt, and silver was cut by the Gavin-Hamilton Co. The company will cross-cut and drift on the vein at the 125-ft. level.——The No. 4 vein on the fourth level of the Big Pete mine in the west drift has widened out to 20 ft. of good milling ore. J. W. Young is superintendent.

The shaft of the Ophir Mining Co. at Cobalt is down 30 ft. The company has erected a head-frame and installed a power-hoist. It is the intention to sink 250 ft. and cross-cut to the vein, which is a few feet from the shaft.——The Campbell Crawford Mining Co. and the Cobalt Silver Prince are to resume work shortly on their properties on the west side of Cross lake.

MEXICO.

MICHOACAN.

The Santo Niño gold mine in the Coalcoman district, about six hours from the Pacific coast, has been purchased by A. R. Downs, his son E. R. Downs, and Thomas L. Woodruff, manager of the Pacific Timber Co. The old workings of the mine are now being cleaned out and new development work will soon be commenced.

NUEVO LEON.

Oil properties in northern Mexico are attracting more and more attention from investors in the United States. It is said a thorough investigation of many leases held by Monterey people is being made by representatives of large northern corporations that expect to enter the oil-producing class in Mexico in the near future.

SONORA.

The Transvaal and Belen mines near Moctezuma are working large crews on development work. This will continue until the Southern Pacific railroad reaches that camp. ——The smelter of the Promontorio is ready to start as soon as the railroad can haul fuel and supplies.——The Monte Cristo is shipping ore that runs 700 oz. silver per ton.

TEPIC.

Several carloads of reduction machinery for the Tenamache mines, north of Santiago Ixcuintla, were recently unloaded at the Pacific port of San Blas, and some of the machinery is now being taken across country to the property. The Tenamache plant will have a capacity of 50 tons per day, and will be one of the most complete in that part of Mexico. The Tenamache mines are owned by the Tenamache Mining Co., of which W. R. Ramsdell is president.

Special Correspondence.

LONDON.

Mount Lyell.—Zinc Corporation.—Dunderland Iron Ore.

The cable advices relating to the results at the Mount Lyell Mining & Railway Co., Tasmania, for the half-year ending March 31, has just been received. The most noteworthy point is that the marketing of the output of copper still gives trouble. As long as the black copper is shipped to the United States for refining and disposal this trouble will last, at least during dull times. One day, no doubt, the new electrolytic works at Port Kembla, New South Wales, which now deals with the Mount Morgan copper, will be available for the Mount Lyell output. The report shows that the 852 tons reported unsold on September 30, 1908, were subsequently disposed of at an average price of £61 6s. per ton. During the six months ending March 31 last the output was 4387 tons of blister copper, containing 4331 tons of fine copper, of which 3243 tons were sold at an average price of £61 17s. 6d.; and 1088 tons carried forward unsold. In addition, the blister copper contained 6856 oz. of gold and 366,706 oz. of silver. The ore treated during the half-year was 134,720 tons from the Mount Lyell mine, and 67,318 tons from the North Mount Lyell, a total of 202,038 tons, averaging 2.64% copper, 1.86 oz. silver, and ⅔ dwt. gold per ton. In addition to the ore treated at the smelters, 13,169 tons were sold to chemical works for the sulphur content. The net profit for the half-year was £126,158, after making due allowance for depreciation, development, and taxes. Dividends for the half-year at the rate of 1s. 9d. per share absorbed £105,000. The manager reports that the cost of producing blister copper was 15s. 3d. per ton of ore, which was 3d. per ton more than during the previous six months, the increase being due to the extra consumption of fuel. The available ore reserves on March 31 are given as follows: At the Mount Lyell mine, available by open-cut, 620,166 tons, averaging 0.6% copper, 1.93 oz. silver, and 0.86 dwt. gold; available by underground mining, 2,613,945 tons, averaging 0.52% copper, 1.97 oz. silver, and 0.5 dwt. gold; at the North Mount Lyell, 713,936 tons, averaging 6% copper, 1.33 oz. silver, and 0.1 dwt. gold per ton. The ore reserves at the North Mount Lyell have been increased during the half-year. The super-phosphate industry is becoming an important branch of the company's business and high-grade iron pyrite in outlying districts is being mined for this purpose.

At the meeting of shareholders of the Zinc Corporation held recently, H. C. Hoover, one of the directors, to whom is due a large share of the credit for the success of the plant, gave some further interesting details regarding the Elmore vacuum process. He mentioned that new furnaces have been erected for the purpose of de-oiling the Elmore concentrate. The first furnaces emitted undesirable fumes, and the new ones are provided with scrubbing towers to mitigate the nuisance. Continual study is being made of the problem of dressing the Elmore concentrate into zinc and lead products, for the effective reduction of lead in the zinc product has a very important bearing on the prices received by the corporation. Mr. Hoover indicated that further improvements were being effected in this direction, and that the production of lead concentrate would before long be substantially increased. He also spoke of the nature of the material which was at the disposal of the corporation, a subject which is of importance, owing to adverse critics saying that the resources of the corporation were limited. At the present time the plant is working on the dump purchased from the Block 10 company, which is admittedly the best and of most uniform material. In determining the capabilities of the flotation processes, it was only natural that the most suitable material should be treated first. Now that a commercial aspect has been given to the process, and its nature ascertained in detail, there is every reason for expecting that it can be equally well applied to other dumps. The Block 10 dump runs about 20% zinc, and there is sufficient left to last for nearly three years. The next dump of importance is that bought from Broken Hill South Blocks, of which there is approximately a million tons averaging 18% zinc. This difference of 2% zinc is naturally an important item, but increasing efficiency will be expected to make up for the decreased content. The corporation also owns dumps bought from the British Broken Hill, and the Block 14 companies, amounting to about 600,000 tons. These dumps are more irregular in character, some parts being richer in zinc than that now treated, and other parts much poorer. Also the nature of the gangue matter varies a good deal. Recently in writing of this corporation's business, I mentioned that an additional unit of Elmore vacuum plant was being erected for the purpose of experimenting on other material. The duty of this plant is to ascertain the most profitable way of mixing the material in these various dumps. Altogether the corporation has enough material to last for 11 years.

For many years the vicissitudes of the Dunderland Iron Ore Co. have been a sort of perennial wonder in the English metallurgical world. Started to treat low-grade hematite ores in Norway, by means of the Edison dry-crushing and magnetic separation process, as yet unproved, the company spent enormous sums in erecting a colossal plant. Year after year one practical difficulty after another cropped up, and large additional sums had to be raised to effect alterations. Finally, last year, the dust difficulty and the low extraction put a stop to operations, and the company went into bankruptcy. David A. Bremner, the manager, reported to the trustees that by the expenditure of another £120,000 or so, the worst defects might be remedied, but he was not at all sure that even then the operations could be conducted successfully. It was therefore decided to approach Dr. Grondal of Stockholm, Sweden, whose process for concentrating magnetite wet has already proved a success, as is generally known to your readers. The Dunderland company owns others besides the hematite deposits which are now being worked. These are of magnetite, and it is proposed to develop them. It is recommended that 10 units of Grondal plant be erected, of which 9 are to be used on the magnetite. The other one is to be used in an experimental way on the hematite ores, in conjunction with a furnace which will render the hematite magnetic. These 10 units should produce 400,000 tons of concentrate per annum. The trustees are recommending the raising of the necessary capital for installing the new plant. Whether success will eventually come to the company remains to be seen, but it is evident that the prestige of Edison as an inventor has once more had a rude shock.

NEW YORK.

International Smelting.—Copper Stocks.—Miami.

Strenuous efforts are being made to create interest in International Smelting stock. Influential brokerage houses in New York are mailing out optimistic accounts of the outlook. Stock of the par value of $10,000,000 is outstanding. The directors propose meeting early next month and declaring a substantial dividend. The amount has not yet been determined, but it will be either at the rate of 8 or 10%. Immediately after that the stock will be listed on the New York Stock Exchange, so that the underwriters may be able to distribute it profitably to the public. The directors' plans regarding fresh purchases of mines and smelters have been considerably interfered with by the death of H. H. Rogers. Some of the options to purchase, however, will shortly be exercised. Steady improvement is noticeable in the copper market. The stocks on hand in the Eastern centres on June 1 were officially estimated at 169,800,000 lb., as compared with 183,198,073 lb. on May 1, 173,284,248 lb. on March 1, and 122,357,266 lb. on January 1. Since January 1 copper stocks in the East have increased by 47,490,975 lb. There are no estimates available for the stocks held by the mines and smelters, but as production is increasing steadily in most places, it appears probable that these are also increasing. Some producers, however, report having been able to place a large part of their stocks at current rates for future deliveries. It is semi-officially reported that the United Metals Selling Co.

has succeeded in placing with consumers a large part of the Amalgamated Copper Co.'s copper stocks for July and August deliveries. Considerable interest is being manifested as to the successor of H. H. Rogers in the management of various copper properties. At the recent meetings of the International Smelting, Amalgamated Copper, Anaconda Copper, United Metals Selling, and other subsidiary concerns, Mr. Rogers' technical advisors were elected to the positions he formerly held. No intimation was given as to the person, or persons, who will have the actual active management. We learn, however, from good sources, that J. P. Morgan will become active in copper matters, and that he will be assisted by William Rockefeller.

In view of the possible advance next winter in the price of copper, Boston mining operators and investors are giving attention to the acquiring of copper properties, with a view to the subsequent promotion. Options have been taken over a large number of copper mining claims in Arizona, Utah, and Montana, and experts are now reporting on the properties. Reports from the Corbin camp, Montana, are very favorable.

The directors of the Miami Copper Co., Arizona, report that the ore blocked out is estimated by the manager to amount to not less than 14,000,000 tons. The company is erecting a smelter and an extensive milling plant near Globe. The mill will have a capacity of 2000 tons. The company's stock has been largely traded in on the Boston and New York curb markets for several months past, and is one of the most popular of recent issues.

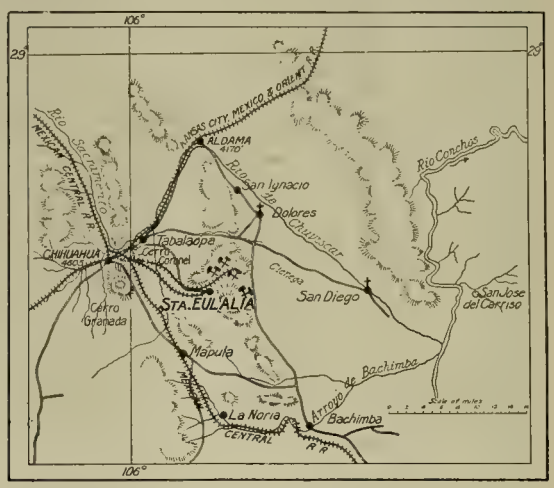
MEXICO.

Extensive Drought.—Railroads in Western Chihuahua.—Santa Eulalia.—Thomas Cole's Investments in Rayon District.

The unusual dry spell through which Mexico has been passing this year has had a most disastrous effect upon all industries throughout the Republic, and mining interests have suffered materially. Many properties have had to close down for lack of water for the mills and for other purposes, and others have been unable to ship ores because the freighters have not dared to take their animals out on the roads where there was absolutely no water. As a rule there are some early spring rains which replenish the supply and enable one to tide over until the regular rainy season, but this year the spring rains have been woefully lacking, and scarcely any part of the country has been favored. In some States the drought has been partly broken during the latter part of May and the first of June. This has given great relief, but so far the State of Chihuahua has been but lightly blessed in this particular, and the question is still serious. The smelters as well as mines have been close to a shut-down. The feeling now, however, is that the worry cannot be greatly prolonged, for the last days of June will bring rains in some districts, and the rivers will carry the waters and relief to others. Much new work is planned for the fall months in different parts of Chihuahua. Chief among these is the one projected by F. S. Pearson and his Canadian associates, including the purchase of the Chihuahua & Pacific and the Rio Grande, Sierra Madre & Pacific railroads, with their extensions until connected, and thence west to the Yaqui river and the Pacific; the building of a railroad from Monclova, State of Coahuila, to the city of Chihuahua; the absorption of the timber interests of the Sierra Madre Land & Lumber Co., and the resumption of work there; and the taking over of one or more of the power-concessions on the Conchos river, certainly that known as the Ginther concession about 15 miles above Santa Rosalía. The impounded water there will give from 30,000 to 40,000 hp., which will be distributed among the mining camps of Santa Barbara, Parral, Almoloya, Naica, Santa Eulalia, and possibly others in the State of Chihuahua, and with the waste waters it is expected to irrigate some 200,000 acres of bottom lands. On this it is expected that work will begin in 60 days.

Next in importance is the work of the American Smelting & Refining Co., whose two trams in Santa Eulalia will soon be connected and working together, when the production of ores will be increased to 500 tons per day. This will call for the immediate addition to the company's Chihuahua smelter, as contemplated, of equipment which will change the plant from three stacks of 450 tons daily capacity to five stacks of 750 tons. The additions to the power-plant have already been ordered. The repairs to the San Toy Mining Co.'s tram, which lost its terminal by fire in the early part of the year, have now been completed, and shipments will be greatly increased. During this temporary curtailment a large orebody recently struck in the company's property has been thoroughly opened, and it is now stated that there is here a showing of 2,000,000 tons of $60 ore, of the lead-silver carbonates so coveted by the smelters.

On the Carmen-Negrita group of 19 pertenencias in the Santa Eulalia district, purchased from the Prieto estate this year by Walter Laclacklen, one of the large holders in the San Francisco del Oro of Santa Barbara, Chihuahua, preparations are being made for sinking a shaft. It is the purpose to sink 1000 ft. before any lateral development is attempted, but the location of this property practically in-



Part of Chihuahua.

sures a successful outcome. At El Cristo, in Santa Eulalia, development is being carried on, but no shipments are being made because of the low price of the metals. From the Chihuahua Mining Co., the Potosí Mining Co., and the Buena Tierra, there has been no curtailment of production, nor at the Reina de Plata. The Parcionera will be again placed on the shipping list within the next month or two.

It now appears that the examinations made of some of the W. C. Greene holdings by L. D. Ricketts and James H. Kirk about six months ago, were for Thomas Cole, and that he, together with Duluth friends, have taken over the Belén, Refugio, and adjoining smaller properties near Ocampo in the Rayón district, and will resume operations before the end of the present year.

JOHANNESBURG, TRANSVAAL.

Underground Breaking and Sorting.—South Reef in Turf Shaft.—Engine Drivers' Demands. — Estimated Output for 1909. — Carbonaceous Matter in Lime.—Technical Education.

Now that the proposed erection of great central electric generating stations gives promise of much power, cheaper and well adapted for underground transmission, the question of underground crushing and sorting is receiving close attention. About 15% of the rock hoisted on the Rand (that is, as much of the practically barren quartzite, unavoidably broken with the conglomerate, as can be safely eliminated) is sorted out on belts, rotary tables, or floors, and sent to the waste dump. Apart from this a small percentage is picked out in the stopes and used for packing. The scheme now in favor is to sort in the levels or near the shaft-bins, underground, the ore to be run through a crusher, washed, and sorted from belts in the ordinary way. The waste

eliminated would be used for packing and save much timbering expense. There would also be a saving in hauling expenses, proportional to the percentage of sorting effected. In a paper read recently before the Transvaal Institute of Mechanical Engineers, W. Calder took rather an optimistic view in assuming 20% underground sorting. The work would probably not be performed as efficiently as on the surface, and the disposal of so large a quantity of rock in old stopes would be costly, especially in mines of low dip. The amount of rock would moreover largely exceed actual requirements for mine support. The scheme of first-stage crushing and sorting at central stations is likely to be most favored.

The reef cut at 3815 ft. in the vertical shaft of the Village Deep (Turf Mines portion) is undoubtedly the South Reef, although a poor banket bed cut 60 ft. higher up was at one time thought possibly to represent that body. As the grade is quite payable, the strike is highly satisfactory and provides further proof of the persistence of the gold content in the reef series at great depths in the Central Rand. In appearance the reef looks remarkably 'healthy', with abundant white pebbles of good size (small pebbles are usually associated with poor grade) and much pyrite. The gold is characteristically erratic in distribution, adjacent samples of a few inches in width jumping perhaps from 20 dwt. to 1 dwt., but it is nevertheless in very fine particles. Rapid changes in value, from foot to foot, is a typical feature of South Reef.

There is a decided scarcity of good engine-drivers upon the Rand today, and an increase in the standard rate of pay from 20s. to 22s. 6d. per 8-hour shift is being asked. The majority of the mines appear willing to make some concessions, even though not to go to the full extent of the demand. As a class, the engine-drivers are on a much higher plane than the miners, in whose strike of 1907 they refused to join. Consequently their demands are being met in a most sympathetic spirit, and no trouble need be anticipated. In some quarters it is suggested that the best solution of the present difficulty (a natural sequel to the scarcity of drivers and the growing demand for skilled men) would be to pay the 22s. 6d. per shift standard to all drivers on main-hoists, but to have them 'lay-off' on Sundays. Although there is no hoisting on Sundays, excepting in connection with emergency work or privileged development, the men put in a full shift cleaning up and at other light work in the engine room which could be accomplished in a few hours by one of the fitters.

The gold outputs declared for the last three months have been disappointing. The excessively heavy rains early this year had a serious effect on production, and the industry has not yet completely recovered. Returns to date stand as follows for the whole Transvaal, of which the Rand accounts for 97 per cent:

	Fine ounces.	Value.
1908	7,052,617	£29,957,610
1909:		
January	615,113	2,612,836
February	565,218	2,400,892
March	607,500	2,580,498
April	607,101	2,578,804
	2,394,931	£10,173,030

This rate of production for 1909 is little over £30,000,000 per annum, whereas £32,000,000 or £33,000,000 have been anticipated as the yield for the current year. In view of mill extensions under completion and new mines preparing, it is still reasonable to hope for the accomplishment of this record. The chief producers in April were the following:

	Stamps.	Yield.
East Rand Proprietary	820	£224,346
Robinson	210	106,346
Simmer & Jack	320	98,917
Robinson Deep	300	84,428
Ferreira Deep	160	78,481

The working costs of the Robinson and Simmer & Jack remain the lowest on the field, at $3 per ton, including development. Cyanide managers have good cause to be thankful for the ventilation of the question as to the presence of appreciable quantities of carbon in our commercial lime, and its deleterious influence as a gold precipitant in the works. There is ample limestone of the best quality in the country, but it is essential to introduce the Hofmann kiln or other efficient plant.

In one of his articles, entitled 'How it Strikes an American' (in your issue of April 3), T. Lane Carter refers to the progress of technical education on the Rand and to the night schools, "where the miners and apprentices may learn something of the theory of their work." Since Mr. Carter's departure, a noteworthy development has occurred in the latter connection by the institution of a coarse of mining lectures, delivered by Prof. John Yates, at various points along the reef. The distance from one end of the double or treble line of working companies to the other being over 40 miles, it is easy to understand that difficulties in the way of attending evening classes were insuperable to many. The experiment of 'taking the lectures to the men' has proved very successful, and the roll of attendance exceeds 200. Of these, about a third may be called 'working miners'—men of practical experience anxious to broaden their knowledge so as to be prepared for the Governmental examinations—and the rest, samplers, surveyors, and others of the official class, who have not had the benefit of a university training. A genuine effort is being made upon mines to increase the number of apprentices, especially in the shops. The industry is not even yet sufficiently settled to make the system popular, since boys find so many opportunities of slipping into well paid jobs without an irksome period of tuition. The practice can only be developed gradually, and because it has not already shown results comparable with conditions prevailing in Europe and America, there are some immoderate critics who proclaim that the mines are playing with the question.

TORONTO, CANADA.

May Cobalt Output — Temiskaming & Hudson Bay. — Kerr Lake. — Silver Lake.—McKinley Darragh.—Gowganda.

May proved a record month for Cobalt ore shipments, which aggregated 2508 tons, as compared with 2492 tons in April. There were 18 mines on the list, the principal shippers as usual being La Rose with 575 tons, and Nipissing with 518. Shipments were well maintained during the earlier part of the present month, notwithstanding which the market for Cobalt stocks continues depressed. The feature of the present week has been a break in Temiskaming, which has lately been on the down-grade, owing to the general impression that the 6% quarterly dividend will not be maintained. The stock, which at the beginning of the year sold as high as 178, dropped to par a few days ago, but has since rallied a little. The effect has been to depress the entire market, except a few leading issues. One of the most important parties which has inspected the camp for some time came recently, in charge of Wm. Starr Bullock, of New York, their special object being an inspection of the La Rose mine. Wm. E. Hidden, who accompanied the party, expressed the opinion that production would continue for 50 years. The shareholders of the Temiskaming & Hudson Bay have voted to organize a holding company, increasing the authorized capital from $25,000 to $3,500,000. Each stockholder will receive 400 shares of new for every share of old stock, and 400,000 shares of the new issue will be left in the treasury for building a concentrator and developing the property. The Kerr Lake reports its May output at 220,000 oz. silver. The main drift on No. 7 vein at the 150-ft. level was driven 72 ft. on a continuous pay-streak of high-grade ore. A new vein showing high silver content has been struck in trenching on the east side of the property. The Silver Queen, which has been under a cloud for some time, has a glimpse of the silver lining, and has shipped two cars of high-grade ore last week. An important strike has been made in the drift on No. 5 vein at the 80-ft. level of the King Edward, where previously no silver had been found. Ore 11 in. wide and assaying over 3000 oz. per ton, with the wall rock on either side being impregnated with silver, was

found. The McKinley-Darragh has declared a dividend of 5% payable July 15. On the Peterson Lake leasehold of the Little Nipissing a 12-in. vein of calcite with good silver content has been struck on a raise between the 100 and 160-ft. levels. A cross-cut at the 110-ft. level of the O'Brien has tapped a vein found some time ago on the surface. It is 7½ in. wide and will run some 4000 oz. silver per ton. The Silver Lead has sunk a shaft 40 ft. on the north end of its property and will put it down 300 ft. in order to strike the Huronian formation, which underlies the diabase. Forty men are at work trenching. The main shaft of the Hargrave on the Jacobs vein is down 270 ft. When it is down 300 ft. a cross-cut will be run to intersect the vein at that level. Frank Loring, consulting engineer of the Wettlaufer mine, in South Lorrain, reports that $15,000 worth of ore has been taken out of the shaft in sinking to 60 ft. The statement at the annual meeting of the Chambers-Ferland on June 9 showed cash in hand, $54,799; ore in transit and at smelters valued at $21,544; and ore in hand, $15,257. The active liabilities were $14,324. A vein of calcite 5 in. wide, carrying native silver, has been found on the Marcel property, James township, and traced 400 ft. Of 19 veins so far found on this location 4 show native silver. A contest for the control of the Peterson Lake Co., which came to a head at the annual meeting at Montreal, May 31, resulted in an amicable arrangement, under which several new directors replaced members of the old board.

The Bartlett mine, Gowganda, has made its first shipment, consisting of 3000 lb. of high-grade ore, by canoe to Latchford. It will assay over 5000 oz. silver per ton. The consignment is made to test the suitability of this route for ore, but owing to the expense it will only be possible, in any event, to send high-grade ore. Vein No. 1 at the Bartlett is reported to be found wider as followed. Other mines at Gowganda have ore sacked ready for shipment as soon as that can be advantageously arranged.

BUTTE, MONTANA.

Amalgamated Report.—British Butte Dredges.—Keating Gold.

The annual statement of the mines of the Amalgamated Copper Co., showing the amount of ore mined, the cost of operating, and the net proceeds for the year ending June 1, 1909, have been filed in the office of the assessor of Silver Bow county for taxation purposes. The reports are of the Anaconda, Boston & Montana, Parrot, Trenton, Washoe, Butte & Boston, Butte Coalition, and the North Butte companies' properties. The total net earnings show an increase of more than $2,000,000 over those of last year, when the aggregate was $4,648,254. The figure this year is $6,719,-799. The increase is shown in the earnings of the Anaconda, the North Butte, the Butte Coalition, Butte & Boston, and Trenton companies. The Parrot company not only shows a decrease, but its total costs exceed its gross proceeds by $12,220. This is due to development that has been under way, and to the further fact that much of the ore mined has been of a low grade. The decrease in the earnings of the Boston & Montana company from the figures of last year is due in part to the enforced idleness of the smelters at Great Falls a year ago, resulting from washouts on the Great Northern railroad. Last winter the extreme cold weather also interfered with the operation of the smelters and necessitated a curtailment. The greatest increase is by the Anaconda company, the net earnings of which exceed those of last year by nearly $950,000. The greatest comparative increase over former years is in the North Butte and Coalition properties, the figures at the former being more than $700,000, and at the latter nearly $400,000.

M. H. DeHora, president and general manager of the British-Butte Mining Co., operating a dredge on placer ground west of this city, has gone to San Francisco to arrange for the construction of five more dredges which will be installed as soon as possible, and at an expense, it is stated, of nearly one-half million dollars. Mr. DeHora but recently returned from London, England. He and the London capitalists interested with him have purchased the holdings of Dr. Eisenberg and J. W. Murphy, and now control fully nineteen-twentieths of a total of 5,000,000 shares outstanding. The company has recently acquired a water-right from Oro Fino gulch, and another large dam is to be built to make room for the operation of the additional dredges. The company has acreage enough to accommodate a score of dredges, and it has been stated that in course of time still more would be set to work. No figures of the clean-up have been given to the public. Mr. DeHora, however, declares that the returns have been eminently satisfactory, larger, in fact, than he had anticipated they would be. It is estimated that the bedrock on the ground being worked is from 2500 to 3000 ft. deep. This will be settled definitely within a short time, for a diamond-drill is to be placed in operation for purposes of exploration along that line.

The Keating Gold Mining Co., operating at Radersburg, in Broadwater county, this State, held its recent annual meeting in Butte, and the reports submitted were of a most satisfactory character. The value of the ore shipped to the Butte Reduction Works since the first of the year amounted to $166,178.96 gross. The company is now working 85 men. A new shaft-house is being erected and machinery which has cost $32,000 is on the ground and will be installed. The shaft is now down 400 ft. and will be driven another 100. The directors elected at the annual meeting are: Julius H. Barnes, of Duluth; R. B. Dear, of Superior, Wis.; C. W. Newton, superintendent of the Butte & Ballaklava property here; and James A. McKee and Jesse B. Roote, of Butte. Mr. Roote was elected president and general manager, and Mr. McKee secretary.

Another company, the Ohio-Keating Gold Mining Co., has been formed to operate the old Ohio mine at Radersburg. They have taken a lease and bond on the property and the first payments have been made. George M. Bourquin and John N. Kirk, of this city, have been active in the formation of the company, and with them are interested B. Binnard and H. H. Thomas, of New York; John F. Cowan, of Salt Lake City; and R. M. Calkins and W. H. Penfield, of Butte. Mr. Cowan will devote a portion of his time to the general management of the property. The deepest shaft on the Ohio is down 132 ft., and when work was abandoned years ago because of a flow of water, was in about seven feet of $32 rock. The ores are sulphides, carrying a large excess of iron over silica.

LOS ANGELES.

Oil Production.—Drilling in Sherman Fields.—Mexican Oil.— Public Lands in McKittrick-Sunset District.

In May $423,470 was paid in dividends on oil stocks in California. The total amount in dividends paid to date is $23,450,604. The surplus storage of the 'independents' of Kern river, Coalinga, and the West Side has accumulated rapidly during the last month, and it is stated that 328,000 bbl. have been produced over deliveries to the Associated. Since the decision to build the pipe-line was reached there has been no effort to curtail production. In the Los Angeles district interest is now divided between the wells in the western extension of the Sherman field, 10 miles west of the centre of Los Angeles, and the four wells now drilling in the Raphetto hills, between East Los Angeles and the Whittier field. Concerning the former there are two theories, each advocated by men who are backing their ideas by drilling. One is that the oil formations trend westward from the old Salt Lake field along the southern edge of the Santa Monica mountain, dipping southward at a fairly regular angle and passing below the reach of the drill in the region of the track of the Santa Monica branch of the Southern Pacific railroad; the other is that there is a southwestward extension of the Salt Lake flexure or faulted anticline, toward Plaza del Rey, which brings the oil sand to within 2000 ft. or so of the surface on the hills north of Palms. At the present rate of drilling one or the other of these theories will be proved within the next two or three weeks. Drilling in the Raphetto hills has produced nothing as yet, although the holes are going down fairly rapidly. Most of the wells are located with the intention of tapping

the lower part of the Fernando formation (upper Miocene, lower Pliocene), the same horizon that is productive in the proved territory in the Los Angeles and Whittier fields. Owing to the steep dip of the strata in this prospective field, it is almost certain that the oil-belt, if developed, will be narrow.

There is much interest locally in the statement issued at Washington regarding the Mexican oilfields. According to C. W. Hayes, Chief Geologist of the U. S. Geological Survey, while these fields promise to yield a large quantity of crude oil, its quality is such that it cannot compete under present conditions in the markets of the United States or Europe with the higher grade petroleum of the Appalachian, Illinois, or mid-continent fields. Further, the conditions are such that the demand for fuel oil and refined products in Mexico exceeds the supply available at present or in sight in the near future. There is practically no coal in Mexico, and the railroads now dependent chiefly on Texas, Oklahoma, and English coal could consume several times the present production of oil if it were generally adopted as fuel. The increased production in the Mexican fields therefore will affect the United States by reducing the demand for coal, by reducing the demand for high-grade crude oil for refining to supply the local market, and to some extent by competing in the European market with American refined products. Finally, the conditions in the Mexican fields are not favorable for the small operator, and it is highly probable that production as well as refining will remain in the control of a very few strong companies. The geological conditions under which the oil occurs are such as to increase the hazards and uncertainties encountered in the development of an oilfield, and it is probable that both the difficulty of securing a steady supply of oil and the average cost of production will be correspondingly increased. This statement will undoubtedly have an influence on tariff legislation. It is understood that the Senate will put oil on the free list.

Approximately 444,890 acres of land in the McKittrick-Sunset district have been restored to entry by R. A. Ballinger, Secretary of the Interior. The lands were withdrawn pending an investigation and classification as to whether they were mineral or non-mineral lands.

WASHINGTON.

Geological Survey and Private Imformation.

The Senate recently asked for explicit information, supposed to have been gathered by C. W. Hayes, chief geologist of the U. S. Geological Survey, regarding the Mexican oilfields. This information was refused by R. A. Ballinger, Secretary of the Interior, a refusal which was endorsed by President Taft. In transmitting instead a general statement, Mr. Ballinger made an interesting announcement as to the policy of the Survey in regard to private information possessed by its officers. He said: "The confidential relation between the public officials and private individuals has held since the organization of the Survey, and has become essential to its successful work, both in the geologic studies of mining districts and in the collection of mineral statistics. Well logs, mine maps, statements of amount, value, and disposition of mineral products are freely given to the Survey, upon the assurance that they will be used only in drawing general conclusions. These details, indeed, have no general interest of value to the public, except as they are incorporated in general statements of conclusions, although they might be used by competitors, to the serious detriment of the persons furnishing them. At the present time the mines in every mining district of the country are open to the Government geologist, without the aid of any special legislation, and upon this relation depends the advance in the study of ore deposits, since equal facility of observation is not afforded to engineers in private practice. The necessary information can be secured in no other way, and to publish such data would be to defeat the end sought. Were the confidence of the mine owner or operator betrayed, the usefulness of this branch of the public service would be largely curtailed."

GOLDFIELD, NEVADA.

Clermont Shaft.—Engineers.— Atlanta. — Diamondfield Black Butte.

The management of the Goldfield Consolidated Mines Co. announces that development will be carried on from the deeper levels of the new Clermont shaft on the Jumbo. As the company has heretofore made no attempt to explore its ground below 600 ft. the results are awaited with keen interest. Owing to the angle at which the principal veins dip it was found inadvisable to sink deeper on the Mohawk. At 600-ft. depth much of the ore is at great distance from the Mohawk shaft, and from that level down may be developed and extracted to better advantage from the Clermont shaft. The stopes on the Lucky Boy claim are opening up a large tonnage of top-grade mill ore, and between this orebody and the Red Top shaft a large and even production is being made, the ore averaging $50 per ton.

A new and important development on the Florence is reported by the management. In the Engineers' vein a shoot of high-grade ore has been cut at the fourth or 200-ft. level, where there is direct connection with the company shaft. The ore is as rich as any found in the mine and is full of gold, much of it yellow and unlike the characteristic bronze gold of the Florence high-grade.

A notable revival of interest in the Atlanta has been brought about by the discovery of a vein carrying a high percentage of gray copper. At a depth of 425 ft. in the Precious Metals Co.'s lease the vein was entered at the end of a 160-ft. cross-cut. It was passed through and the parallel vein opened for a width of 7 ft. The gray copper was in evidence everywhere. First assays showed but $2 gold, but later tests show $8. The ore occurs in dacite. Driving is in progress on the vein and sinking will be resumed.

Operations on the Yellow Tiger have ceased, but it is announced that within 30 days sinking from the 700-ft. level will be resumed and the shaft sunk to 1000 or 1200 ft. The work has been performed by the Elks Consolidated lease, backed by John F. Campion and associates. Local reports which have been widely copied in the press have credited the Yellow Tiger with discoveries of high-grade ore, but the best that has been exposed has been a large vein with only nominal amounts of gold. The chief interest attaching to operations at this point is the distance from the producing centre of the camp and the broad scope of work carried on by the company. Leases on the Blue Bell are following narrow stringers of rich ore from the surface, having abandoned work at over 400-ft. depth because of the expense. On the Commonwealth a tunnel is being driven to the vein by lessees operating on the original company workings. The Nevada Gold Ore Mines Co.'s lease on the Gold Bar claim of the C. O. D. Consolidated has suspended operations for the time being, after sinking 600 ft. and starting drifts on a vein of excellent appearance. The principal lease shaft on the Lone Star will be sunk deeper to cut the vein, in which good ore was found at 250 ft. Several shafts are being sunk in the neighborhood of Vindicator mountain, and there is a decided revival throughout the district in point of development on outside territory.

On the claims of the Goldfield Merger Mines Co. development is in progress at the 600-ft. level from the company shaft, and laterals will be opened above this level to explore the known veins which have produced rich ore from the upper levels. Several leases on this ground are producing rich ore from nearer the surface. The Original Velvet lease resumed lately and shipped pay-ore from the start. The Codd lease on the St. Ives has been taking enough ore from a small vein near the 50-ft. level to pay operating expenses; the Kansas City Velvet has shipped quantities of rich ore and its rich vein has widened in the workings lately, insuring a profitable output; and the Combined Mining & Leasing Co. has let a contract for additional cross-cutting to reach the junction of the St. Ives vein and another strong lead from which high-grade ore has been taken near the surface. A complete hoisting plant has been installed on the Nancy Donaldson mine, in the eastern part of the district, and J. C. McCormack will develop this group on a liberal scale. Exceedingly rich ore has been found near the point at which the shaft is being sunk.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Russian lineal measure is as follows: 1 totchka equals 0.01 inch; 1 liniia, 0.1 in.; 1 vershok, 1.75 in.; 1 archine, 2 ft. 4 in.; 1 sagene, 7 ft.; 1 verst, 0.66287 mile. Measures of area are 1 square sagene, 49 sq. ft.; 1 dessiatina, 2.6997245 acres; 1 square verst, 0.43940829 square mile.

Sill is the name given by geologists to a uniform intrusion of molten material between the bedding planes of stratified rocks. They may generally be distinguished from flows contemporary with the sedimentation by the alteration of adjacent rocks above as well as below, and by stringers or dikelets penetrating the superincumbent strata.

Evaporative power, which is also called the calorific value, of a fuel is the number of pounds of water evaporated at 212° F. by the combustion of 1 lb. of the fuel. To express it in terms of British Thermal Units (B. T. U.), the number of pounds of water evaporated is multiplied by 967, which constant is the latent heat of vaporization of water.

Water for ice-making should be taken from the coolest possible source as a matter of economy in refrigeration. In some places artesian water is taken for this purpose. Such a case is that of the United Ice & Coal Co., at Harrisburg, Pennsylvania, where a cost-reduction of 30% is obtained in that way. Where water is abundant cooling towers may be employed to reduce the temperature before freezing in the machines.

Assessment work on a mining claim consists of $100 worth per annum. Litigation has been active over the question of what constitutes $100 worth, such suits usually arising where claim-jumping has been attempted. The surest rule for determination of what amount of work satisfies the requirement is to honestly decide whether you would consider the amount done as worth $100 if it were part of a campaign of development for which you had to pay in the furtherance of gainful mining operations.

Saltpetre has suffered no diminution in demand as a result of bacterial nitrification of soils. The producers of saltpetre (sodium nitrate) in Chile, declare that the attempts at wholesale nitrification through innoculation of leguminous seeds, especially of peas, has failed completely in Germany and England, and that no pronounced success has been attained in the United States. However this may be, the problem of securing cheap fixed nitrogen is still one of the most important of our day.

Mining concessions in Egypt may be of unlimited size. The grants are in the form of leases, for which the price varies according to the kind of metal. The claims are based upon the feddan as the unit, this being equivalent to 1.038086 acres. In addition a tax of 10% is levied upon the net profit accruing from operating the concession. In the Sudan the areas are limited to the following maxima: gold and silver 160 acres, other metals 360, oil 640, and coal 1280. Leases must be rectangular in shape, and the length may not be more than four times the breadth.

Paramagnetic substances are those more permeable to magnetism than air, which is taken as the standard and represented by 1; diamagnetics are those less permeable than air. Paramagnetics are attracted by a magnet, diamagnetics are repelled. While chemically pure minerals possess magnetic permeability independently of any iron they may carry, in practice it is almost always the effect of a trace or more of iron, either chemically combined or present as an impurity, that is utilized in magnetic separation. Strongly attracted substances are sometimes called ferro-magnetic.

The Kristiania type of copper deposit was named from those near Kristiania, formed by gaseous emanations along a contact between igneous rocks and sedimentaries. Hence they are 'pneumatolytic' deposits. At the type locality in Norway, such masses are found between syenite and Silurian limestones and slates. The minerals constituting the ore consist of chalcopyrite, magnetite, galena, hematite, sphalerite, and rarely bismuth, and arsenical and antimonial sulphides, with garnet, amphibole, pyroxene, mica, epidote, vesuvianite, scapolite, quartz, calcite, fluorite, and axinite.

Tierra del Fuego, or the Magellan archipelago, is remarkable for its mineral resources. Lignitic coals are abundant in many parts, and the quality is excellent, an approximate average being: moisture, 14.5%; volatile hydrocarbons, 43.05; fixed carbon, 42.15, and ash, 9.9. It was estimated by a recent commission that the ratio of efficiency compared with Welsh anthracite was as 2 to 3. Gold exists abundantly, and immense masses of 'low-grade porphyry' copper deposits exist. The maze of islands, compactly grouped, with deep-water channels everywhere, render facilities for mining extraordinary. Extensive glaciation makes prospecting easy. On the west side of the group the climate is no more severe than that of Sitka, Alaska.

Standard abrasion test for road-metal as adopted by the American Society for Testing Materials requires 30 lb. of coarsely broken stone to be available, and that there shall be placed in the cylinder as nearly as may be, 50 pieces weighing 11 lb. The cylinder is placed at an angle of 30° with the axis of rotation. The cover on the cylinder being tight fitting, the material is thrown from one end of the cylinder to the other, this continuing for 10,000 revolutions at the rate of 30 to 33 per minute. At the end of the test the worn material is the part which is fine enough to pass through a sieve having $^1/_{16}$-in. mesh. The percentage of wear may be used in comparing different materials, or the French coefficient of wear, which is $400 \div W$. W is the weight in grams of detritus under $^1/_{16}$-in. per kilogram of rock used.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Small Cyanide Plants in Colombia.

The Editor:

Sir—Small cyanide plants could do a splendid business here on rich auriferous silver ores. It is very hard, in this country to raise large capital, but there are many available purchasers for moderate-sized equipment. With a small plant it is possible to go on with development, increasing the business slowly. We would be glad to know of firms which would look into this kind of business. I am connected with a company owning a property which yields ore containing pyrite, mispickel, and galena, assaying on an average 60 oz. silver and 1 oz. gold per ton. This concern would be glad to buy such a small plant.

F. PEREIRA GAMBA.

Pasto, Colombia, May 1.

Occurrence of Gold in Placers.

The Editor:

Sir—I hope your prophecy that "a fresh discussion of this interesting topic will ensue," may be realized. It is not only a subject of deep and wide interest, but also one of great importance. Moreover, as Mr. Garrison remarks, quoting Posepny, certain features of it at least "cannot be easily explained." The more reason therefore for combination in the effort. In school days we were taught that all placer gold was produced by erosion; that the gold and rocks were carried, together, to the beach or stream-bed; that there the gold at once began a downward course through the gravel; that this descent was rendered possible by a very slight but constant 'tremble', caused by the flow of the water throughout the entire mass of gravel whatever its depth; that the gold continued to descend until stopped by an impervious bed—either a band of clay (false bedrock) or bedrock. That theory has much to commend it, and it readily explains why, when the 'fill' is composed of clean sand and gravel, without clay, most of the gold, and particularly the coarse gold, is found on or close to bedrock. But there is one phenomenon that it not only does not explain, but which, on the contrary, seems entirely incompatible with it. I refer to the influence exercised by the nature of the bedrock on the distribution of the gold. Rough bedrock, because the crevices act as riffles, is much more likely to carry gold than a smooth bedrock. Smooth bedrock, pitching up-stream, is likely to be richer than the same kind pitching down. On Eldorado creek in the Yukon were numerous bands of a soft putty-like bedrock with a smooth though uneven surface. It apparently made little difference how this pitched, it was always poor, and frequently barren. These bands were generally narrow, but, in some cases, extended throughout an entire claim (500 feet).

Such bedrock-influence as the above is easily explained by supposing that the stream-bed acted like a miner's sluice-box, but that would seem to entail the further supposition that the 'run of gold' occurred during a certain portion only of the stream's life-time, and that it invariably ceased when the bed began to accumulate gravel, because how could it act as a sluice-box with 50 or 100 ft. of gravel above bedrock? This latter supposition is, of course, untenable, particularly in view of the frequent occurrence of rich streaks resting on clay-bands high up in the 'fill'. Mr. Garrison doubts the theory of the descent of gold through a body of gravel, because coarse gold is quite often found high up in the 'fill'. I would suggest as an explanation that such gold has either been captured before it had time to complete its journey, or, and this is more common, it is found in a stratum sufficiently clayey to arrest or greatly retard its downward progress.

There is another theory, a combination of the two I have mentioned, which, if true, would seem to account satisfactorily for all the 'vagaries' of placer-gold occurrence. This theory is to the effect that the entire 'fill' of valleys and stream-beds is slowly moving downhill. The point that renders it hard for me to believe this is the existence of the above-mentioned gold-supporting clay-bands. Could such bands, sometimes only a few inches in thickness, and not always of a tenacious nature, maintain their continuity while being transported down stream-beds whose cross-section is constantly varying between wide limits?

W. F. COLLINS.

Battle Mountain, Nevada, May 31.

Co-Operative Topographic Surveys.

The Editor:

Sir—In response to your enquiry, I take pleasure in making a statement of the policy of the Geological Survey in the matter of co-operation between the Federal Survey and State organizations.

The question of meeting the co-operation in topography offered by the States has reached a crisis. Last year $160,250 was offered by 16 States, and, acting upon the advice of the Secretary of the Interior, I decided to limit co-operation on the part of the Federal Survey to $100,000, or one third of the appropriation. This involved a reduction of at least 20% of the amounts accepted, save in the case of States offering $2500 or less.

This year approximately $250,000 is offered by 22 States for co-operation in topographic surveys. Making a percentage cut is only temporizing with the situation. A definite policy is demanded. Until specific provision is made in the appropriation for co-operative work, two general considerations must govern in planning the distribution of the "topographic surveys in various portions of the United States." First, the special claims of the public lands States, where the Federal interest in the adequate mapping is paramount by reason of public ownership of land. Second, the progress of the topographic map of the United States as a whole, in which connection it is to be noted that the percentage of area surveyed in the

States offering co-operation is already higher than in non-co-operating States—40 as contrasted with 32% —and this difference is by no means wholly due to the amount of work done under co-operation.

The policy which has been determined upon will fix maxima for co-operative allotments, and grade such allotments on the basis of percentage of area already surveyed. A maximum of $20,000 will be permissible for co-operative allotments, and that only in States of which less than 35% has been surveyed, this being the percentage for the whole United States. For States with from 35 to 70% of area already surveyed, $15,000 will be the maximum amount permissible, and for States with over 70% surveyed, $10,000 will be the maximum. Where the co-operative surveys are on a larger scale than is necessary for the topographic map of the United States, the Federal allotments will be adjusted on a basis other than that stated above. Even under this arrangement it is expected that the co-operative allotments by the Federal Survey this year will aggregate over $160,000. This increase over the amount allotted last year is rendered possible only by reason of the $50,000 increase in this year's appropriation. The Federal allotments to meet State co-operation will bear their proportionate share of the necessary expenses in connection with the proper execution of the field and office work, but this share is levied upon the basis of only the Federal half of the co-operative work, although it is obvious that the field work paid for by the State funds necessitates a corresponding increase in most of the administrative expenses.

GEO. OTIS SMITH.

Washington, D. C., June 3.

More Thought About Silver.

The Editor:

Sir—Early in the present year I expressed the opinion in your columns that the price of silver would advance materially before next Christmas. This forecast was made after considering the conditions in force in the countries where it was mainly produced and consumed, together with the market fluctuations for a number of years past. I can see no reason as yet for modifying the views then expressed, but the following item, clipped from your issue of May 22, tempts me to send you a few more thoughts on the subject: "Seigniorage, or profit on coinage of silver by the Government, in 1907, the last year reported, was $9,095,044. In the last ten years the Government revenue from this source has amounted to $75,684,972."

The United States product for the year 1907, consisting of 56,514,700 oz. (or about 193 avoidupois tons of 2000 lb. each), had a value, as a commodity, of $37,299,700. On this it appears that Uncle Sam made a profit of more than nine millions of dollars by the easy, if not wholly justifiable, process of buying the metal at the market price of, say, 50c. per ounce, coining it into money at the ratio of $1.29 per ounce, and pocketing the difference. It is safe to say that an equal amount was made by the several European governments in the same way, and probably twice as much by those of Asia that are under English, French, and German control, and mainly by the British-India Mint operations. So that, altogether, in round numbers, the civilized governments of the world must have realized nearly forty million dollars during 1907 in clean profit out of the silver mining industry, without sticking a pick into the ground, which profit, moreover, was in the nature of a direct tax upon the miner. As the gross commercial value of the world's silver crop for that year was $127,520,029, it looks as if the producer paid a tax of nearly 30% for the privilege of conducting his business. At that rate he will be 'done up' in short order. In fact, the process is already accomplished, for silver is now almost wholly a by-product, and even the producers of lead, copper, and gold, who used to count a little on the white metal in their ores to help them out, have about given up doing so.

But it does seem rather disreputable for governments to be deriving income in that way, and to be dealing so extensively in what is actually a debased coinage, kept afloat by ignorance among the masses, and confidence (not always justified) among the classes. And is it not a fine wind-up to the theories of the gold-standard people, who carried their point by insisting that the poor man's white dollar must be intrinsically just as good as the rich man's yellow one? Of course it won't do to breathe the subject of bi-metallism again. It is out of vogue, and extremely unfashionable. Yet the business men of the great trading nations have for some time been wondering how it is that they make such slow progress in their commercial conquest of the East, which was to be brought about in short order by the adoption of the single standard. It is worthy of note that every now and then fresh proofs arise to show that the Orientals, instead of acting as they were expected to, have taken many steps toward becoming manufacturers themselves, and are certain to continue moving rapidly in that direction. Why not? Labor has not advanced in price among them to anything like the extent it has with us, nor have the values, in their money, of the raw materials they produce.

As an example of how soon questionable policies, when steadily pursued, seem to become justifiable and proper, witness the following remarks in a recent issue of that eminently respectable paper, the *Springfield Republican*, anent the complaints along our northern border of the considerable amount of American silver coins afloat in Canada. It is estimated that quite two million dollar's worth (face value) are circulating quietly there. The main objectors are the bankers, who are advocating legal steps to effect its exclusion. Says the *Republican*: "This would be no advantage to the Canadian banks of issue, since they put out no notes below the denomination of $5, but there would be advantage to the Dominion Government, which, at the present difference between the price of silver and the face of the coins, could clear a profit of 50c. on each dollar's worth of fractional coin minted to take the place of the United States coin circulating there." The *Republican* seems to see nothing wrong or discreditable in the procedure suggested, all American coins being afloat on substantially the same footing.

Something might be done for the white metal if the producers got together and made public protest against this debased condition of silver coinage the world over. It would, of course, be impracticable as well as inadvisable to put more metal in the coins. But perhaps the subject is a more vital one at present to Europe than to America. With our immense internal trade, that of Canada and Mexico immediately adjoining us, and the whole of Latin America to the south, we can afford to wait until England, Germany, and France find the situation intolerable, and take steps toward a solution. The single standard idea originated in Europe, which is but a slight producer of either of the money metals, but, for a thousand years past has occupied the position of banker, manufacturer, and distributor for the rest of the world. From it as a centre modern civilization has spread in every direction. It has been in a position to demand payment for its goods and services in the kind of coin it preferred, and it chose gold. Coincidently, however, in those parts of the globe where the balance of trade was against it (notably Asia) it has paid its obligations in silver, which indeed was the only money the East would for a time accept. But during the last fifty years the United States has been steadily encroaching on its trade. Simultaneously the Asiatic balance to be settled has been growing as the East increased its exports. Again, as Europe advanced in manufacturing, its agricultural industries waned, until at present it is extensively dependent for food upon the newer parts of the world. It has drawn its silver almost entirely from the two Americas for the last 400 years.

A very interesting condition of affairs is arising from this combination of circumstances. Europe is losing its gold, and simultaneously some of its trade. At the same time, as the result of international jealousies, taxes have increased so greatly that the burden of life to the poor is becoming intolerable, and the most energetic and valuable citizens are emigrating. Much of the stored up wealth of the rich is also disappearing. Many natural resources are approaching exhaustion. Europe is visibly approaching bankruptcy. If it is to continue deriving support from the sale of its manufactures, it must be able to draw raw material from other parts of the world at cheap prices. Its ability to do this is waning. It has only gold to pay for what it must have, and the value of commodities in terms of the yellow metal is rising everywhere. The alternative is for European manufacturers to move their plants nearer to the sources of raw material, and to the consumers. This movement is well under way, and the movement is most notably toward those countries where silver money is practically the only kind known, and where it still retains its ancient purchasing power. As this trend of affairs becomes more pronounced, the demand for silver will grow, and its price advance. Nothing is more certain than that it is one of the metals most necessary to civilization, even more so than gold.

Meanwhile silver producers would do well to get together. In this age of the world publicity is one of the most valuable of weapons, both for offence and defense. The general public has little or no information as to why the metal is such a drug in the market, and what an outrageous tax the producer of it has to stand. Few bankers or financiers grasp the fundamentals of the subject of money. This is inevitable, for, after all, their work is simply to effect the processes of exchange, regardless of the nature of the materials and tools of the business. But it is the proper task of the producer to stimulate the market for his goods. Until the silver miner takes this work vigorously in hand, the rest of the world will go stumbling along on its wonted way, wondering vaguely, when it does think on the subject at all, what the metal was made for anyway, unacquainted with the wonderful part it has played in the past in the history of commerce and civilization, and unconcious of the rôle it is cast for in the future, when the thousand million Asiatics take their inevitable and rightful position among the nations of the globe.

THEO. F. VAN WAGENEN.

Zacatecas, Mexico, June 8.

Mixed Geography.

The Editor:

Sir—For some months I have not been in touch with your journal and have only recently seen your issue of January 23, 1909, and on page 147 I noted with some surprise your clipping commenting on an article by myself and headed 'Mixed Geography'. I enclose a copy of a letter I am sending to the Editor of the *Queensland Government Mining Journal*, and would consider it a favor if you would make a similar correction.

G. M. COLVOCORESSES.

New York, June 3.

[The letter referred to is given below.—EDITOR.]

Sir—I have just seen the enclosed paragraph on 'Mixed Geography' in the MINING AND SCIENTIFIC PRESS of January 23, 1909, which appears as a clipping from your paper and accuses me of saying that "Mt. Morgan is best reached from Queensland, New South Wales, etc." I would suggest that when you quote and criticize articles appearing in other periodicals it is a good plan to have the periodical itself before you and make quite sure that your quotation is correct. In this case no such statements were ever written by me nor did they appear in the *Yale Scientific Monthly*. My article appeared in the issue of April 1908, which is before me as I write and the statements which you so misquoted were as follows: "'Mt. Morgan' is located in the State of Queensland 25 miles inland from the seaport of Rockhampton in Latitude 23° S. * * * To reach 'Mt. Morgan' one leaves Sydney, New South Wales, in the late afternoon, on the north-bound express. * * * Rockhampton, though only 900 miles from Sydney, is almost forty hours distant; one passes through some very fine agricultural and grazing country and through the famous mining camp of Gympie." I trust my geography will meet with your approval and that you will do me the courtesy to publish correctly these quotations from my article and withdraw your previous comments.

G. M. COLVOCORESSES.

New York, June 3.

HISTORICAL GEOLOGY OF CALIFORNIA.

Written for the MINING AND SCIENTIFIC PRESS
By WILLIAM FORSTNER.

Literature on the historical geology of California is scattered through a great number of publications, and any engineer requiring data on this subject must search through a long list of works to find the different views expressed on the subject. The data are contained in the detailed descriptions of different portions of the State, which are found scattered through the publications of the U. S. Geological Survey for the Sierra region and northern California and in those of the University of California, the State Mining Bureau, and various technical periodicals. The object of this paper is to collect and epitomize this literature so as to serve as a guide.

Archean.

Evidences of Archean masses, principally gneisses, have been found at some points in the Sierra Nevada



Map of California.

region, and probably in San Bernardino county. These gneissoid rocks have been brought to the surface at many points by upheaval and erosion, and the suggestion that they are of Archean age appears well founded.[1]

Paleozoic.

During the Paleozoic era the Archean land mass lying west of longitude 117°30′ probably extended westward, including part of the area now occupied by the Sierra Nevada. Its western shore was apparently somewhat west of the present crest, although it is by no means impossible that an Archean land mass existed on the site of the present Coast range. The Paleozoic sediments, which now constitute a large portion of the centre of the Sierra Nevada range, were laid down in the sea extending westward.[1]

The Sierra Region. Lower Cambrian rocks have been ascertained to exist in the eastern portion of Inyo county, in the White mountains, and west of Big Pine.[2] Silurian and Devonian formations have been found in the northern part of Plumas county; namely the Grizzly and Taylorville formations (Silurian), and the Arlington formation (Devonian).[3] Outside of these local exposures, no fossils older than the Carboniferous have as yet been found in the Sierra Nevada. The Paleozoic deposits on the western slope of the Sierra Nevada have been summarized under the name of the Calaveras formation, which, while principally composed of Carboniferous sedimentary and igneous rocks, contains also probably older rocks. In some portions of the Sierra these rocks pass so insensibly into amphibolite schists, derived from ancient tuffs, as to suggest that volcanic activity occurred at this period. The rocks of the Calaveras formation have been strongly altered by later earth movements, so that fossils are only occasionally found in the limestones distributed through it; consequently it is impossible to obtain paleontologic data for the differentiation of its subdivisions.[4] In older geological works the name of 'Auriferous slates' was used, covering besides the Paleozoic, also the Mesozoic deposits. This name, however, is not used in the later works.[5] In the northern end of the Sierra Nevada, close to the Lassen Peak region, some Upper Carboniferous strata, the Robinson or Little Grizzly creek beds have been identified, and differentiated from the Calaveras.[6] In that region in close proximity to each other, are the Silurian, Devonian, Carboniferous, and Upper Carboniferous rocks. This occurrence tends to confirm the suggestion that within the range, among the Calaveras rocks, are included those belonging to the older Paleozoic. That these have not been differentiated is because their more thorough metamorphism has obliterated nearly all paleontological evidence.

Northern California. The oldest known rocks in the Klamath region, west of the Sacramento river, are mica (sericite) schist and hornblende-schist, the Abrams and Salmon-schists. Their age is, as yet, doubtful. They may be Silurian or older, but all that can be stated with certainty is that they are pre-Devonian.[7] The oldest fossiliferous rocks yet recognized are of Middle Devonian age, namely, the Kennett formation; this is underlaid by a heavy series of eruptive volcanic material, the Copley andesite and Balaklala rhyolite. These are undoubtedly older than the Kennett, but their relation to the crystalline schist cannot be defined, as they are separated from

[1] 17th Annual Report, U. S. Geological Survey, Part I, p. 529; Journal of Geology, Vol. III, p. 387; and Tenth Census U. S., Vol. XIII, p. 47.

[2] American Journal of Science, Vol. XLIX, p. 14.

[3] Folio 15, U. S. G. S.; and Bulletin Geological Society of America, Vol. III, p. 370.

[4] Gold Belt Folios, U. S. G. S.

[5] 8th Ann. Rep., U. S. G. S., Pt. I, p. 402; Bull. Geol. Soc. of Am., Vol. V, p. 257.

[6] Folio 15, U. S. G. S.; and 14th Ann. Rep., U. S. G. S., Part II, p. 446.

[7] Folio 138, U. S. G. S.; Am. Jour. of Sci., Vol. 165, p. 342; and American Geologist, Vol. XXVII, p. 244.

the schist by a large belt of much younger granodiorite. From these Devonian rocks upward, there is in the Pit River section, a rather complete succession of Paleozoic rocks, intercalated with numerous beds of volcanic material. There are two belts of the crystalline schists running nearly parallel in a northwesterly direction. The southwestern runs from near Ono, Shasta county, through Trinity and Humboldt counties. It forms the South Fork mountains, the divide between Mad river and the South Fork of the Trinity river, and reaches the coast near the mouth of Redwood creek. The other belt runs through the Bully Choop and Salmon mountains, continuing northward into Siskiyou county. Between these two belts lies a belt of highly metamorphosed Devonian and Carboniferous sedimentaries, associated with large masses of various igneous rocks, which latter cover a far larger area than the sedimentaries.[8] The western schist-belt is limited to the west by Mesozoic rocks, and apparently there is here a fault, which has elevated the block of the Klamath region. All the strata dip to the northeast. To the east of the northeastern belt are extensive masses of rocks of igneous origin, and then comes the wide belt of Paleozoic and younger rocks, crossing the Sacramento river, all dipping eastward. The volcanic rocks underlying the Kennett formation have been laid down on land; subsequently there must have been a subsidence, allowing the deposition of the marine Middle Devonian (Kennett). To the west of Gazelle, Siskiyou county, limestone containing an Upper Devonian fauna has been found; this formation has not been found in Shasta county, and here the Lower Carboniferous (Bragdon) rests apparently on the Middle Devonian. The Lower Carboniferous (Bragdon) consists partly of volcanic material, especially its upper portion, which is sometimes designated as the Baird formation; then comes, in ascending order, the Upper Carboniferous McCloud limestones, overlaid by the McCloud shales or Nosoni formation, chiefly tuffs; and further eastward the Mesozoic rocks. These formations have generally the structure of monoclines with an easterly dip, which leads to the suggestion that in this region the shore-line of the early Paleozoic sea was by a series of uplifts, accompanied by volcanic acitivity, gradually pushed eastward.[9] The important copper deposits west of the Sacramento river are situated in the pre-Kennett volcanics; the epoch of their formation is, however, as yet unknown. In Siskiyou county most of the copper deposits are situated in the areas of schist, often in quartzite belts included within these schists. The Paleozoic rocks were in later times intruded by basic rocks, to a great extent altered into serpentine, and subsequently invaded by huge masses of granodiorites.

Coast Ranges. While the age of the basement complex of crystalline rocks—granite, gneiss, crystalline schist, and metamorphic limestone—is not yet positively ascertained, it has been suggested as a hypothesis, that they may be Paleozoic, and it has been shown that there are some reasons for considering them to be Carboniferous.[10]

Southern California. In the range running west from the Tehachapi to the coast occur gneisses and schists, which may be Paleozoic or older.[11] The Peninsula range embraces the San Jacinto, San Bernardino, and Santa Ana ranges, and continues southward as one mountain chain, forming in its southern portion the backbone of the peninsula of Lower California. It is formed wholly of crystalline schists and massive rocks, respecting the age of which there is great diversity of opinion.[12] It may be Paleozoic.

Mesozoic.

Sierra Region. The Trias is only represented at the two extremities of the Sierra Nevada. Southwest of Mt. Whitney are the Mineral King beds;[13] and in the extreme northern end of the Sierra, in the Taylorville region, are the following Trias formations: the Swearinger slates, resting unconformably upon the Carboniferous; the Hosselkus limestone; the Trail beds; and the Foreman beds. They consist principally of slates and limestones. There is an unconformable relation between these Triassic beds and the overlying Jurassic.[14]

After the close of the Carboniferous, and before the deposition of, at least, the later Jura-Trias, an upheaval took place by which the Carboniferous and older sediments were raised above sea-level, folded, compressed, and rendered schistose. Smaller masses of granitic and other igneous rocks were probably intruded at this time. Then, after a considerable interval, followed the intrusion of the diorite-gabbro-pyroxenite group, and subsequently that of the diabase and allied porphyrites, or meta-andesite group. The age-relation of these intrusions with the Jurassic Mariposa beds is not clearly determined; they all have been greatly altered by subsequent earth movements, and to a great extent have been rendered schistose. There is reason to suppose that eruptions of the last-named group occurred both in Carboniferous and Jurassic times.[15] Considering the above mentioned distribution of the Triassic rocks, there is a probability that the mass of the Sierra region was above sea-level during that period; that this land mass was bordered on the north by the ocean, along the depression of the Lassen straits, and that a local submergence took place at the north end of the Sierra Nevada. The above noted Trias-Carboniferous unconformity in the Taylorsville region, which is not found north in the Pit River region, confirms the hypothesis. The presence of the Jura-Trias unconformity in this region indicates that it was also included in the general pre-Jurassic disturbance which involved the entire region of what is now California. In the main Sierra region are some Jura-Trias beds, the Sailor Canyon, Milton, and Monte de Oro beds, lying unconformably on the Paleozoic.[15] In the Northern Sierra the Lower and Middle Jurassic are

[8]Am. Jour. of Sci., Vol. 165, pp. 343-350; and Am. Geol., Vol. XXXI, pp. 234-236.

[9]Jour. of Geol., Vol. II, p. 589.

[10]Am. Geol., Vol. XI, p. 324.

[11]Am. Geol., Vol. XXIX, pp. 274-280.

[12]11th Report California State Mining Bureau, p. 76.

[13]14th Ann. Rep., U. S. G. S., Pt. II, p. 451.

[14]Bull. Geol. Soc. Am., Vol. III, pp. 372-374.

[15]Sierra Folios, U. S. G. S.

represented by the Hardgrave sandstone, Thompson limestone, and Mormon sandstone.[14] During the earlier part of the intrusions of diabase and porphyrites above recorded, the land area of the western portion of the Sierra Nevada subsided and the late Jurassic Mariposa beds were laid down.[16] After the deposition of the Mariposa beds and the close of the accompanying igneous activity, the important post-Jurassic orogenic disturbance, which also involved all the region west of the Sierra Nevada, took place. As a result of this movement the Sierra Nevada was uplifted as a great mountain range. This movement was accompanied, or followed, by the most far-reaching phase of igneous activity in the form of large batholiths of granodiorite, which took place at a great depth, but now revealed by erosion.[15 16 17]

The last phase of the history of the 'Bedrock series' now covers the Sacramento valley, as there are evidences that during the Cretaceous the Sacramento valley was gradually subsiding under the great load of sediment brought into it, both from the Sierra Nevada and from the Coast range, while probably at the same time these two ranges were gently rising.[19] According to another hypothesis, it is doubtful whether during the Cretaceous anything at all comparable with the present Sacramento valley existed, and that the shore-line was west of the present eastern rim of that valley.[20] For the subdivision of the Cretaceous, see below, under, 'Coast ranges.'

Northern California. The Klamath mountains and the Cascade range are separated on the south from the Sierra Nevada by a broad depression in the pre-Cretaceous rocks, running transversely to the general trend of the Sierras, and named the Lassen



Sierra Nevada Foothills Near Copperopolis.

(Paleozoic and Mesozoic rocks of the Sierra Nevada) was the formation by compressive stresses of an extensive series of joint-fissures, in different directions, generally, however, not coinciding with the old lines of dynamic disturbances. Along these joints and fissures ascending thermal waters altered the country rock, deposited the ores, and their age is therefore early Cretaceous.[16] Some of the gold-quartz veins of the Mother Lode, however, were formed prior to the deposition of the Mariposa formation.[18]

During the Cretaceous the Sierra Nevada range was greatly eroded, and no Cretaceous rocks are found in the Sierra Nevada except on the lower west slopes, in the northern part of the range, and a small isolated exposure north of Lincoln. It is, however, possible that the Cretaceous along the west slope of the Sierra Nevada is overspread by the alluvium that strait. This depression was beneath the sea-level during Chico times.[21] The correlation of the pre-Cretaceous formations on Pit river and near the North Fork of Feather river, confirms this hypothesis. The older Mesozoic formations are differentiated from the Cretaceous by their thorough metamorphism. In the Pit River region the Trias is represented by the Pit shales, Swearinger slates, Hosselkus limestone, and Brock shales; the Jura by the Bend formation, which includes at its top the Mormon sandstone, or the Modin and Potem formations.[22] In this region the Jura-Trias unconformity is clearly observable. The Triassic and Jurassic volcanic activity, to which are due the Dekka andesite and the Bully Hill rhyolite (Trias), and the Bagley andesite (Jura), was submarine,[23] which indicates that the

[16]17th Ann. Rep., U. S. G. S., pt. II, p. 102; and Folio 66, U. S. G. S.

[17]Bulletin Department of Geology, University of California, Vol. III, No. 15, pp. 299 and 362.

[18]Folios 28, 37, and 66, U. S. G. S.

[19]17th Ann. Rep., U. S. G. S., Pt. I, p. 352; and Bull. Geol. Soc. of Am., Vol. V, pp. 452-457.

[20]Bull. Dept. of Geol. Univ. of Cal., Vol. I, No. 14, p. 384.

[21]8th Ann. Rep., U. S. G. S., Pt. I, p. 401.

[22]Folio 138, U. S. G. S.; and Jour. of Geol., Vol. II, p. 601.

[23]Folio 138, U. S. G. S.

Pit River region was not elevated above sea-level during pre-Cretaceous Mesozoic times.

The copper deposits near Copper City and Ingot, formerly Furnaceville, are in the Triassic eruptives, but their age is unknown. After the deposition of the latest known Jurassic sedimentaries (the Potem), and before that of the Cretaceous, this region was involved in the post-Mariposa volcanic activity, already noted in the Sierra region. This occurred chiefly along or close to the western rim of the Triassic, throwing long apophyses into the Carboniferous. These igneous rocks range from granodiorite to hornblendite, and in structure from batholithic to narrow dikes.[23] Their occurrence would indicate that they represent differentiated extrusions of one magma. The granodiorite is very similar to that of the Klamath region.

In the Lassen Strait region the Chico is the only representative of the Cretaceous. It is exposed in the form of long tongues, which have been uncovered by the erosion of the younger formations. During the earlier Cretaceous this region formed part of the land-area of northwestern California and southeastern Oregon. Then followed a period of subsidence, until, in the latter part of the Cretaceous, the ocean reached to the western base of the Sierra Nevada and to the Blue mountains in Oregon. This depression evidently did not include the region north of Pit river, as here no Cretaceous has been found. During the earlier Cretaceous there must have been numerous earth-movements, and the lower portion of the Cretaceous is much more disturbed than the upper, Chico portion.[24] The Jura-Trias history of the Klamath Mountain region has yet to be worked out in detail. About the close of the Carboniferous, and before the deposition of the Triassic, there was an extensive movement, resulting in uplifts accompanied by extrusive volcanic activity, by which portions of the Klamath mountains were elevated above the sea. Strata of Triassic and Jurassic age may have once covered the Klamath region and have been removed by subsequent erosion,[25] but according to the latest data, no Jura-Trias deposits have been found west of the Sacramento river in this region. In the Klamath mountains the post-Jurassic volcanic epoch is represented by huge masses of granodiorite and more basic eruptives, the latter being altered into serpentine over large areas. The granodiorite formed numerous extensive belts, a large one of which forms the Trinity and Scott mountains. Considerable deformation and alteration of the older strata occurred during this period of volcanic activity. The Klamath Mountain section was uplifted to a higher altitude than before.[26] While the principal exposures of copper ore are in the Paleozoic or older formations, the gold-quartz veins are mainly in the granodiorite. A genetic similarity with the gold-quartz veins of the Sierra Nevada is to be noted. This epoch of mountain-building closed with the Pacific coast of northern California from 10 to 30 miles west of the present coast line,[26] and during the earlier Cretaceous (Knoxville) the Klamath region remained above sea-level. The Klamath mountains are surrounded by Cretaceous sediments, and isolated patches of Cretaceous strata occur at a number of points in these mountains.[27] Whether the entire Klamath district was submerged in the latter portion of the Cretaceous, or whether a portion formed an island, is as yet a disputed point. During the Knoxville the Klamath mountains were deeply eroded, and the detritus was deposited in the littoral. As the region subsided, parts of the interior became submerged, and the Horsetown, besides overlapping the Knoxville which surrounds the Klamath mountains, covered at least a part of the interior, and its remnants may be found in four detached basins lying on a line about E.N.E. from Rattlesnake creek to Redding creek. Their present condition is due to a post-Cretaceous folding of the strata in that direction, leaving the remnants along the axis of a syncline, with the axis bearing N.E. The direction of this disturbance is almost perpendicular to those which determined the distribution of the Paleozoic formations. We have thus in the Klamath district two main systems of folding, nearly at right angles to each other.[28] The Chico surrounds the Klamath region, and remnants are found in several places in the Klamath mountains.[29] The Cretaceous represents in the Klamath region and the Coast range a long period of relative absence of volcanic activity, combined with subsidence. At the close of the Cretaceous, orographic movements occurred, the Klamath Mountain region was uplifted above sea-level, and has remained so ever since.[30] This uplift was not regional, for both to the north and south Eocene deposits are found in the Coast range.

Coast Range. The historical geologic record of the Coast range begins in the Mesozoic. The crystalline basement complex may be Paleozoic, or may include Paleozoic rocks, but this is mere hypothesis. Between these crystalline rocks and the well defined Lower Cretaceous rocks appears a series of rocks which have variously been called the Metamorphic series, the pre-Cretaceous, the Golden Gate, and the Franciscan. The last name is at present generally adopted. This series consists of a basal conglomerate; a moderately fine-grained, greenish or bluish-gray sandstone, weathering yellowish; limestones, radiolarian cherts, volcanic rocks and lavas, serpentinized intrusives, and cherts affected by local metamorphism.[31] These form an irregular complex. The metamorphism resulted essentially in re-crystallization, serpentinization, and silicification;[32] and the characteristic structure which serves for its ready identification is due to sudden and sharp disturbances, resulting in crushing and fracturing the strata, rather than to uplifting and

[23]Bull. Geol. Soc. of Am., Vol. IV, pp. 220-222.

[24]Am. Geol., Vol. XXXI, p. 241; and Folio 138, U. S. G. S.

[25]14th Ann. Rep., U. S. G. S., Part II, p. 423.

[27]Bull. Geol. Soc. Am., Vol. IV, p. 214.

[28]Am. Jour. of Sci., Vol. 165, p. 356; Am. Jour. of Sci., Vol. 164, p. 335.

[29]Bull. Geol. Soc. of Am., Vol. IV, p. 214.

[30]Bull. Geol. Soc. of Am., Vol. IV, p. 222.

[31]15th Ann. Rep., U. S. G. S., pp. 416-435; Monograph XIII, U. S. G. S., p. 72; Folio 101, U. S. G. S.; Jour. of Geol., Vol. III, pp. 416-426; Am. Geol., Vol. XI, pp. 70, 71, and 324; Bull. Geol. Soc. of Am., Vol. VI, pp. 71-102.

[32]Mon. XIII, U. S. G. S., pp. 57 and 181.

folding.[33] The uniform, characteristic lithological features of this series, which render it easily identified in the field, are very valuable, as there is a scarcity of fossils. The series is certainly younger than the oldest known Californian Cretaceous, the Knoxville. Whether the latter is at the base of the Cretaceous or not is a point of dispute.[34] The metamorphism of these beds is probably due to the post-Jurassic disturbance. They are younger than the crystalline basement complex, and separated from them by a long interval of time, but as the age of the latter is also undetermined, all that can be stated with certainty regarding the age of the Franciscan series is that it is pre-Cretaceous Mesozoic.[35]

There has been discussion as to the character of the radiolarian chert; it has been variously defined as phtanite, jasper, and chert. It consists of thin



Slates of the Sierra Nevada, Placerville, California.

beds of radiolarian cherts with much thinner shale partings. The rhythmically thin bedding of these cherts remains as yet unexplained.[36]

Throughout the series are a number of volcanic rocks, including basaltic lavas, diabases, and pyroclastic accumulations, which furnish abundant evidence of intermittent volcanic activity during the deposition of the sedimentaries of the Franciscan series. There is here a noteworthy similarity with the Lower Mesozoic in the Pit River region. There, however, the alteration of the rocks was not so great as to destroy all paleontological evidence. The rocks of the Franciscan series were finally intruded by peridotites and pyroxenites, now largely altered to serpentine, which have caused, by contact metamorphism, the local formation of crystalline schists of a wide range of petrographic character; but principally glaucophane-schists. The age of this intrusion is also a matter of discussion. By some it is claimed to be pre-Knoxville; others claim that portions of the Knoxville have been invaded by these intrusions.[37] These often occur at the contact of the Franciscan and the Knoxville. North of the bay of San Francisco the Coast range, or ranges, consist principally of the Franciscan series. South of the bay the ranges near the coast, the Santa Cruz-Gavilan range and the Santa Lucia range, consist mainly of rocks of the crystalline basement complex, but Mount Diablo consists chiefly of the Franciscan series, which sinks beneath the Tertiary near Polonio Pass. The Franciscan series forms the axis of the Cujama range, and its most southerly exposure is on the west slope of the San Rafael mountains.[38] They have not been observed in southern California.[39]

The Cretaceous beds are found throughout the Coast ranges, principally along the eastern slope. They have their greatest development in Tehama and southwestern Shasta county, and must have covered a large part, if not the entire area, of the present great valley (see above, under Sierra region). They were apparently derived from the erosion of both the Sierra Nevada and the Coast ranges. The Cretaceous is split into four divisions, which are, in ascending order: the Knoxville, predominantly dark shales, with thinly bedded sandstones, except in southern San Benito county, where the sandstones predominate; impure limestones are frequently found in this formation; the Horsetown, predominantly olive-colored shales with some thin beds of sandstone, at the base generally a conglomerate (these two form the Lower Cretaceous or Shasta series); the Wallala beds, sandstones and conglomerates, locally developed on the coast of Mendocino and Sonoma counties (they may properly be considered as a phase of the Chico); the Chico, predominantly soft sandstone, with some shale beds.

The overlapping of the younger beds upon the older, clearly indicates the continuous subsidence of the continent during Cretaceous times. There is evidently a faunal continuity between the Knoxville-Horsetown beds and the Chico, although there are marked indications of disturbances during the long period of deposition, the Lower Cretaceous beds being generally much more disturbed than the Chico,[40] which resulted in local non-conformities.[41] From the distribution of the Cretaceous in the Coast ranges, it is evident that a part of it did not subside beneath sea-level during that period, as, especially in the southern portion, the Lower Miocene is in many

[33]Auriferous Gravels, p. 15; and 15th Ann. Rep., U. S. G. S., p. 465.

[34]Jour. of Geol., Vol. III, p. 426.

[35]Bull. Dept. Geol. Univ. of Cal., Vol. II, No. 12, pp. 354 and 355.

[36]Bull. Dept. Geol. Univ. of Cal., Vol. I, No. 7, pp. 198 and 235, and Vol. II, No. 12, p. 354; Mon. XIII, U. S. G. S., pp. 105-108; 15th Ann. Rep., U. S. G. S., pp. 420-425 and p. 465; Folio 101, U. S. G. S.; Bull. Geol. Soc. of Am., Vol. VI, p. 71.

[37]11th Rep. Cal. Sta. Min. B., pp. 55-57; Mon. XIII, U. S. G. S., pp. 183 and 251; Am. Geol., Vol. XI, p. 324; Jour. of Geol., Vol. III, p. 428; and Bull. Geol. Soc. of Am., Vol. II, p. 394.

[38]Am. Geol., Vol. XI, pp. 70-73.

[39]11th Rep. Cal. Sta. Min. B., p. 76.

[40]Bull. Geol. Soc. of Am., Vol. IV. pp. 204-222.

[41]Jour. of Geol., Vol. III, pp. 426 and 427.

places found resting on the Franciscan. The most southern exposure of Cretaceous strata in the Coast ranges as yet known is found near Point Sal, Santa Barbara county (Knoxville) and in the San Rafael mountains (Upper Cretaceous?).[42]

Southern California. Our knowledge of the Mesozoic geology of southern California is, as yet, quite limited. Rocks of the Metamorphic series (Franciscan) are mentioned as occurring at several disconnected places, and there are Cretaceous rocks at Point Loma, east of Carizo Springs, and in Silverado canyon, in the Santa Ana mountains. The granitic rocks of the San Gabriel and Santa Monica ranges, micaceous gneisses and granites, are probably of late Jurassic age. Near Newhall they contain a very light oil.[43]

(To be Continued.)

South Australian Mining in 1908.—A review of mining operations in the State of South Australia for the half-year ended December 31, 1908, is contained in Bulletin No. 9, recently issued by the Mines Department of that State. The total value of all minerals won for 1908 was £457,900, against £814,220 for the year 1907, the decrease amounting to £356,320, or a reduction of over 43%. For the months under notice standard copper averaged £61 1s. per ton, and for the whole year £60 0s. 10d. per ton. The mineral leases numbered 1205, comprising an area of 100,387 acres; the registrations for the last half of 1908 numbering 641, with an area of 44,429 acres. The number of men employed totalled 6350, copper mines employing 4470; gold, 880; salt, 450; silver-lead, 50; other minerals, 500. The returns from the Government crushing and cyaniding plants show that 1216 tons were treated, yielding 1208½ oz., valued at £3887, the average yield per ton being 64s. In the Northern Territory, the Arltunga battery and cyanide plant treated 344¼ tons for 387½ oz., valued at £1401; and at the Winnecke's Depot, 263¾ tons for 114 oz., valued at £427 6s. In regard to subsidies to mining companies, it is shown that since the inception of the system, the total advanced was £46,231 10s. 4d., of which £6055 12s. 6d. has been recovered, leaving a debit balance of £40,175 17s. 10d. A portion of this outstanding debt is represented by machinery that has fallen into the hands of the Government, and, the report says, "add to this the value of the metals won, and the State in general will probably have benefited beyond the money value of the debit balance." In two instances only have the profits won enabled full repayment—the Crystal mine, at Echunga, which repaid £76 7s. 6d., and the once famous New Alma and Victoria mine, Waukaringa, which repaid in full the first subsidy of £3000. The remainder of the recoveries was derived from sales of mining plant.

Saghalien is to become a producer of oil. A German company has secured a concession to operate on the east coast of that island, where good oil has been found in abundance at 120 feet.

[42]Bull. Dept. of Geol. Univ. of Cal., Vol. II, No. 1, p. 18; and Bull. No. 322, U. S. G. S., p. 28.

[43]11th Rep. Cal. Sta. Min. B., pp. 76-120; and Bull. No. 309, U. S. G. S., pp. 5 and 145.

KNUDSEN PROCESS OF PYRITIC CONVERTER SMELTING.

Written for the MINING AND SCIENTIFIC PRESS
By O. BERGSTROM.

I had the opportunity of seeing the operation of the Knudsen converter at the smelter of the Sulitjelma Aktie Bolag, at Sulitjelma, Norway. The process was invented by Emil Knudsen, the manager for the Sulitjelma company. It it protected in the United States by patent No. 721,311, of February 24, 1903. It has now been in operation four years, practically without any change except an increase in size of converter charges from 8 to 12 tons. This increase has shown many advantages in the operation of the converter, and there is now a 20-ton converter in course of construction. The ore smelted at Sulitjelma consists mainly of copper-iron pyrite with 15% silica. It is fluxed with an ore containing 60% silica, so that the composition of the charge is as follows:

	Per cent.
Copper	6.31
Sulphur	36.02
Iron	33.25
Alumina	3.41
Silica	21.00

The furnace in which this charge is smelted is a converter with a bottom of peculiar shape. This shape has been found necessary to obtain a bath of fused material quickly. The furnace is lined with magnesite bricks, which lining is usually renewed every 30 days, especially in the smelting zone. In starting the furnace, about 200 lb. of bituminous coal is shoveled into the converter, a gentle blast turned on, and a 12-ton charge of the above composition is introduced.

Through the courtesy of Mr. Knudsen the 12-ton converter was placed at my disposal for a period of 10 days, which time I devoted to proving the process in regard to the silica percentage possible in the slag, and also the concentration that could be obtained in the furnace. The slags thus produced varied from 25 up to 40% SiO_2, without affecting the time of the operation, the slags highest in silica being somewhat lower in copper. The complete settling of the slag at the time on a large scale was not possible, as the reverberatory forehearth was not ready. Settling tests made in large crucibles showed that slags from a 50% matte, which were allowed proper time for settling, contained about 0.5% copper.

The concentration can be carried to any degree desired, regardless of the silica percentage in the slag. The lowest percentage of copper in any charge that I could use at the smelter was 3.55; it was blown up to a 72.39% copper matte in 4 hours, and the slag after 5 minutes settling inside the converter assayed 0.78% copper. The wear and tear of the lining I found to be practically all mechanical, partly caused by grinding and friction of the raw ore charged, partly by the expansion and contraction due to the variations of temperature to which the furnace is subjected. There seems to be no chemical action on the lining, as the slag analysis showed only a trace of magnesia. As the renewal and wear of the magnesite lining is the most expensive part of the process, fire-

brick may be substituted for the lining in the upper portion of the converter. This will probably last as long, and make a difference in the first cost.

The blast is started with low pressure until a good portion of the charge is molten; it is then slowly increased to 20 lb., and continued until the flame at the nose of the converter indicates that the proper grade of matte has been reached, when the contents of the converter are emptied into a forehearth or settler by tilting. The time necessary for one charge is 3 to 4 hours, so that 5 to 6 charges can be treated in 24 hours. The blowing engine is of German make, with one cylinder, 38 by 38 in., operated by water-power. It delivers about 4000 cu. ft. of air per minute. The labor at the furnace is 1 charge-wheeler and 3 furnace attendants per shift, the total smelting cost being $1.05 per ton. This cost will be considerably reduced with the 20-ton converter.

From the above it is readily seen that this smelting is strictly pyritic. No fuel is used, with the exception of about 1% of the charge in starting the burning of the pyrites. This fuel may be coal, coke, or wood. After the sulphide has started to burn, the oxidation of the sulphur and iron, with the formation of the silicates, will supply abundant heat to complete the operation. The great fluidity of the slag, even when highly silicious, shows that there is an excess of heat developed. Ores with a sulphur content as low as 24% can be smelted in this furnace.

Later types of the converter are larger, the increase in the size being principally in the length. It is now supported on wheels, on account of its great weight, and not on trunnions, and is tilted by electric power. A new double-cylinder blowing engine is being installed, as it was found that the one previously in use could not supply sufficient air-pressure for all the tuyeres. Several have been plugged, and the charges are 15 tons, instead of 20. Sometimes in the smaller converters the charges used to 'hang up' or stick to the sides; meanwhile the matte in the bath was subject to the blast and became too high in copper before the mass was brought down. This does not occur in the large converter, the charge sinking more uniformly. Concentrate or fine ore may be smelted in quantity up to 30 or 40% of the lump ore without more loss than in the reverberatory.

Hot-blast has also been tried. The effects were the same as in blast-furnaces, namely, open and bright tuyeres. However, it was found to possess no merit. In fact, it was detrimental to the furnace, and therefore discontinued. With regard to the lining, the writer suggested that the bricks be laid on edge instead of flat, in order to strengthen them against destruction from large pieces of ore in charging from a chute. This change, in addition to a modification of the bottom of the converter, and the increased capacity, has resulted in a great saving of the lining —in fact, only one-third of the number of bricks per ton of ore smelted are now used as compared with five years ago. The matte produced contains 45% copper, which is best suited for the small silica-lined converters; the slag has been settled in the fired forehearth, and the copper assays of the slag show about 0.5%. The metal losses are about the same as in the American plants and practice. The matter of costs demands consideration. These have been lowered considerably on account of the saving of magnesia bricks and the increased capacity. Blister copper can be made by the Knudsen furnace, but not economically, and should not be recommended. The advantages which the process offers over pyritic smelting in blast-furnaces are mainly great simplicity, high concentration, even with high-iron slags, and the practical elimination of all carbonaceous fuel. By utilizing the waste heat from the fired forehearth to generate a part of the power required for the blowing engine, or by using cheap electric or water power, the cost of smelting by this method will in many instances be considerably lower than the cost by other processes now applied to the treatment of sulphide ores, and the Knudsen process deserves therefore the consideration of the progressive metallurgist.

DREDGING IN VICTORIA.

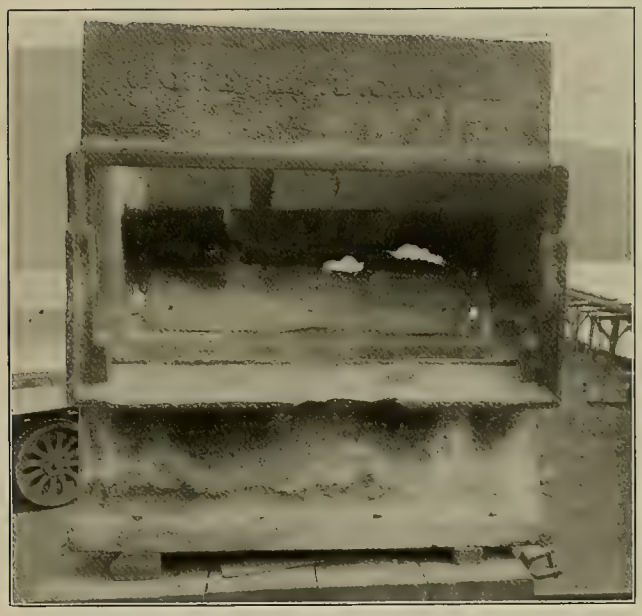
In Victoria the official term 'dredge mining' is applied to bucket dredging, hydraulic sluicing by centrifugal pump and by the jet elevator; while the term 'hydraulic sluicing' is applied to gravitation plants. According to the report of E. H. Goodenough, acting officer in charge of the dredging branch of the Mines Department, there were, on December 31, 1908, 47 bucket dredges, 71 pump sluicing plants, 6 hydraulic sluicing plants, and 5 jet elevators at work. The number of leases held amounted to 239, covering an area of 24,053 acres. During the year 20,703,092 yards of material were treated with a return of 105,808 oz. gold, valued at £422,234, or an average of 2.4 gr. per cu. yd. of solid matter dealt with. The area worked was 777 acres, which averaged 134 oz. per acre. The gold produced shows an increase of 6346 oz. over 1907. The total expenditure in wages paid and maintenance was, approximately, £305,000, while dividends paid amounted to £63,784, an increase of £25,679 on the previous year. Tin produced during the term amounted to 62½ tons. The initial cost of the plants at work was £646,426. Some ingenious methods are used to stack the tailing at high levels. In some cases the gold-saving boxes are placed in the paddocks at race level. All the material sluiced is run through the boxes and the gold saved before the debris reaches the pump-hole. This enables the delivery pipes to be set at a flatter grade and to deliver into one short length of box at the head of the tailing pump, insuring 10 ft. more stacking room under ordinary conditions. A patent gold-saving box has also been used rather extensively, with good results, as high as 15% of gold being saved thereby. In this box a break is made, generally half-way down. The discharge is caught in a receiving hopper and thrown back a few feet into the head of a set of boxes placed immediately below. This break has the effect of immediately precipitating any gold, especially fine floating grains, that escape from the upper box. Attempts at re-soiling the dredged ground have not so far been satisfactory. The only system tried has been that of sluicing the soil on the tailing after stripping it separately, and the conditions are not favorable to this in the Ovens River watershed.—*Australian Mining and Engineering Review.*

SALT WATER IN STAMP-MILLS.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

The accompanying photograph illustrates the effect of salt water when used in the stamp-mortars of the Alaska Treadwell mine, in Alaska. During winter when the sources of fresh water are locked by ice, it is necessary to use salt water from Gastineau Channel, an arm of the sea. Even in summer the water from the ditches has a low temperature—about 42°F.—by reason of the chilling effect of the ground-ice. The battery-water is not warmed artificially. An experiment with tepid water was made and it was found that it softened the amalgam too much.

The corrosion of the iron by the sea-water shortens the life of the mortars to an appreciable degree. This is probably due to electrolysis, the salt water



Mortar Corroded by Sea-Water as Used at Treadwell, Alaska.

acting as electrolyte and the iron of the mortar as the positive element of a couple; the negative element may be amalgam or mercury in contact with the iron, or possibly copper derived from traces of copper sulphate in the partly oxidized pyrite of the ore. Such copper sulphate would be dissolved in the battery-water and then precipitated by replacement of the copper by some of the iron of the mortar—a replacement that would be facilitated by the presence of the chlorides of the sea-water. The couple thus formed would cause the conversion of further amounts of iron into a readily soluble chloride of iron, resulting in corrosion. If the cast-iron itself is not homogeneous, local electrolysis and corrosion may also be started by segregations within it, when an electrolyte such as sea-water is present. Corrosion of a similar character, and due to similar causes, takes place in boilers and tubes in which sea-water is used, and is most apparent in the vicinity of brass fittings. Thus iron chloride is formed, this being a salt readily soluble in water, so that it is removed, with corrosion as evidence. At the Exposed Treasure mine, at Mojave, in Kern county, California, it was the practice of Courtenay De Kalb to add common salt (5 lb. per ton of ore) to the ore as it was fed into the chutes above the stamps. This was done in order to facilitate the precipitation of the copper by the battery iron in accordance with the reactions above mentioned; it being found economical to precipitate the copper into the amalgam rather than allow it to become a cyanicide in the treatment of tailing. The copper existed as sulphate in decomposing pyrite and went readily into solution.

Some years ago sea-water was in use at a cyanide plant on Cedros island, off the coast of Lower California, and it is stated that no difficulty was encountered from the presence of salt in the solutions. In the Pelatan-Clerici process, and certain other modifications of the cyanide process aiming to precipitate the gold directly from the pulp by electrolysis, a considerable proportion of common salt was added in order to increase the conductivity of the solution. While these methods have never been widely used, the failures recorded appear to have been due to other causes, and as far as known were not traceable to the use of salt in connection with cyanide.

Another point is the density of sea-water, which has a specific gravity of 1.03 as compared to water at 1. Concentration is affected by the density of the medium employed; other things being equal, the dense medium is the most effective in separating substances of nearly equal specific gravity. Ordinarily an increase in specific gravity of the liquid medium increases efficiency up to a point where the density lies between that of the two solids, a liquid midway in density giving (barring excessively fine particles, that is, slime) an absolutely perfect separation, on the principle of Thoulet's or Sonstadt's 'heavy liquid' sorting of minerals. Taking two solids of sp. gr. 2.5 and 3, neglecting viscosity of medium, the relative settling rates in water should be:

2.5 — 1 and 3 — 1; the ratio of these is $\frac{1.5}{2}$ or 0.75.

With sea-water of sp. gr. 1.03 they would be 2.5 — 1.03 and 3 — 1.03. Then $\frac{1.47}{1.97} = 0.7462$ instead of 0.75, so that the difference in this case would be quite small and possibly balanced by the difference in viscosity.

In Western Australia, before the Government water system was completed, the mills used the brackish water pumped from the mine. In some cases this desert water was almost saturated with salts. At Menzies in September 1897, I found that the water used in the Queensland Menzies mill contained 17% salts. For this liquid they were paying $6.25 per thousand gallons. At Kalgoorlie, the water carried from 10 to 15% of salts, mainly sodium chloride, magnesium chloride and sulphate, calcium sulphate and traces of the carbonate. Sea-water

contains 3½% salts, mainly common salt. As far as I could learn the brackish character of the water did not injure the screens in the stamp-mills, although it accelerated rust and impeded settling of slime. Although it was more difficult to make the plants look clean than in mills employing fresh water, there were no injurious effects in the battery or the tube-mill, in cyanidation or in precipitation. A. Blomfield, who was shift-boss in the mill of the Lake View Consols, tells me that they had trouble with the settling of slime and the choking of filter-cloths. The amalgamating plates in the pans (used for treating roasted concentrate) kept in excellent order. When a change was finally made from salt mine water to fresh river water, there were many difficulties in the precipitation room. These were soon overcome, in one case (Lancefield) by adding common salt.

In cleaning the tables, in the Alaska Treadwell mill, their surface is first washed with a jet of water to remove particles of ore. A wooden cover is laid over the copper plates, resting on the cleats that fasten the plates to the table; this leaves a 1½-in. space between the cover and plates. All openings along the sides and at the top and bottom are closed with strips of burlap; a hose is inserted at a point one-third the way from the head of the plate and live steam is admitted at a pressure of 35 to 65 lb. The steam is allowed to act for 20 minutes and is then turned off. The wooden cover is removed and the softened amalgam is scraped off with chisels. The amalgam has become as soft as Swiss cheese and about as brittle. The mercury is partly volatilized by the heat, and the men are careful to stand back when the cover is raised. Warning is given by the fact that the brass sockets of the electric lights hanging over the tables become amalgamated. In cleaning the tables, the men wear a wet sponge at their nostrils. When the amalgam has been scraped off, the plate is dressed with a weak cyanide solution; it is then dressed with fresh mercury, using whisk-brooms to spread the globules of mercury uniformly.

In the Ready Bullion mill, at Treadwell, the vanners are provided with wooden rollers, it having been found that the salt water corroded both galvanized iron and steel tubing. This mill uses salt water for eight months out of the twelve.

The ore of the Alaska Treadwell and the adjoining mines is simple and homogeneous. It is unoxidized up to the very outcrop, which was covered with a blue clay that protected the lode from weathering. The gold contents of the ore can be gauged from the assay of the concentrate. When new screens were put in the Seven Hundred mill, the grade of the concentrate fell to $40, from $70, per ton. At the same time on the same ore the Mexican mill was making a $70 concentrate with No. 4 diagonal slot screen, equivalent to about 18 mesh, as against woven wire screens crushing to 30 mesh in the Seven Hundred mill. It is apparent that the concentrate is enriched by fine gold that escapes amalgamation. Re-grinding promotes further extraction, as has been proved by cyanide experiments made by Walter L. Brown. Screen tests show that the stuff retained on 40 mesh is richest in every case, whether ore-pulp or concentrate. Finer material assays less. In concentrate there is a big decrease below 80 mesh and in ore-pulp below 60 mesh.

The mill last built, namely, the 300 stamps of the Alaska Treadwell, differs from the 240-stamp mill, for example, in having heavier stamps, anvil-blocks, concrete foundations (as against timber foundations), individual cast-iron guides, and direct-connected water-wheels (as against a rope-drive from one single wheel). The vanners are in a separate building. Notwithstanding these improvements, the extraction exhibits but slight difference. The 300 mill shows an average tailing of 19 cents per ton from an ore averaging $2.31 per ton, while at the 240 mill during the past year the tailing averaged 20 cents from an ore containing $2.51 in gold. But the new mill crushed 5.5 tons per stamp, while the other crushed 4.51 tons; in consequence the cost of milling is 22 cents per ton in one case and only 12 cents in the other. On the other hand, one pound of iron in the dies crushed 6.28 tons of ore in the 240 mill and 4.88 tons in the 300 mill. These dies were cast in the Treadwell foundry.

Although the Alaska Treadwell is one of the biggest mines in the world, it has no dump. No pile of waste rock has been accumulated in front of the shaft-houses. All the material coming out of the mine passes through the crushers, even the waste, for there is no provision for rejecting such rock as is not milled. Men experienced in mining will be favorably impressed by this fact, as indicating the uniformity of the product coming out of the mine, but the tourist misses the conical waste-heaps usual in mining districts, where a large dump is often accepted as impressive evidence of the size of a mine.

Kapsan copper mines.—The most important copper mine in Korea is the well known Kapsan mine, situated in South Ham-Kyung, North Korea, the ownership of which, after a period of four years of negotiating between the Korean, Japanese, and American governments, was, in June 1908, conceded to the American claimants. According to the report of an English engineer who examined the mine two years ago, and confirmed by subsequent examinations by other engineers about nine months later, this mine has been worked for many years and was then producing about 300,000 pounds of smelted copper annually. Analyses of this copper showed it to contain 98% copper and unimportant amounts of gold and silver, and practically no harmful impurities, the balance being chiefly iron and sulphur. The ore occurs as large irregular deposits in limestone, and the mine has, thus far, been worked by primitive native methods. The American concessionaires have now sent engineers to prepare detailed plans for the future operation of this property in accordance with modern methods.

The Japanese mineral output felt the effect of hard times last year. Minerals to the value of 14,000,000 yen were won from the different mines of the country, a falling off from the previous year of over 3,500,000 yen.

PHOSPHATE CLAIMS ON PUBLIC LANDS.

The hearings of the Committee on Public Lands at the last session of Congress on the subject of the disposal of the phosphate lands in Wyoming, Idaho, Utah, New Mexico, and Arizona have just come from the Government Printing Office, and form a most interesting chapter in the history of mining. It will be remembered that after a meeting of the National Conservation Commission last year, in which the statement was made that there was a great scarcity of phosphate in the United States, James R. Garfield, then Secretary of the Interior, withdrew the phosphate lands from entry, pending an investigation into their extent and value. The lands remain withdrawn, the bill introduced by Frank W. Mondell of Wyoming which provided for their location and entry under the placer mining law having failed to pass. Mr. Mondell's bill was intended to clear up a muddled situation. Some of the claims have been entered as placers and others as lodes. In addition to providing that all claims in the future should be entered under the placer mining law, the bill provided that all lands containing phosphate deposits that had heretofore been located under the laws providing for the entry of mineral lode-claims might be patented under the provisions of this law, but that no title so acquired to lands containing such deposits should give the locator any rights beyond the perpendicular limits of his claim. A further provision of the bill was to the effect that in case of conflict between locators under the placer laws and the mineral lode laws on locations heretofore made, the respective claims were to be determined as though the location of these lands under either of the above laws was valid at the time the locations were made.

The hearings on the bill drew out the widest possible divergence of opinion among attorneys representing the owners of deposits, members of Congress, and geologists. It was contended most vigorously that the phosphate deposits were not placer deposits, and should be entered under the mineral lode law. This was denied just as vigorously. It was declared that not only was the phosphate supply of the United States extremely limited, but that there was also a scarcity of phosphate throughout the world. This statement was also combatted with much spirit, the attorneys representing the owners of the deposits disagreeing with the officials of the United States Geological Survey as to the supply available. Those who took part in the discussion were James R. Garfield, Secretary of the Interior; Frank Pierce, Assistant Secretary; George Otis Smith, Director of the Geological Survey; Frank Mondell, Representative from Wyoming; L. E. Payson, former member of Congress, representing locators under the lode land law; Aldis B. Browne, attorney, of Washington, representing the San Francisco Chemical Co., which owns phosphate deposits entered under the placer-mining laws; Benjamin Micou, an attorney in Washington, representing Lucius T. Brown, of Nashville, Tenn., the owner of 23 claims in Idaho, located under both the placer and lode laws; and F. B. Weeks, of Washington, formerly connected with the Geological Survey, who had examined the deposits. Mr. Garfield stated to the committee his reasons for the withdrawal of the phosphate lands, declaring that the Geological Survey officials, in their study of the phosphate question, had called attention to the fact that in a great many localities throughout the country, especially in the agricultural areas of the older States, there had been a rapid loss in the productive value of the soil because of a lack of re-fertilization, and that there would be need in this country for great amounts of phosphate. Mr. Garfield was followed by Mr. Smith, who said that the investigations of the Department of Agriculture had shown that the soil of the country now under cultivation was being exhausted of its content of phosphoric acid at the rate of about 2,000,000 tons per year, and that to replenish it would require at least 6,000,000 tons of phosphate rock annually. "We know that through a period of years the production of phosphate rock has quite rapidly increased in this country," said the Director. "We know that in South Carolina, Florida, and Tennessee the production is now something in excess of 2,000,000 tons per year. We know that the total production has been about 30,000,000 tons, and that since 1900, 14,000,000 tons have been exported to replenish the worn-out lands of continental Europe. In South Carolina, at the present rate of production, the supply will be exhausted in 12 years, and the same in Florida. At the present rate of production it would last over half a century in Tennessee but for the fact that as soon as Florida and South Carolina leave the market the Tennessee production must increase very rapidly, and that means that probably in about 25 years we will see the end of the high-grade phosphate rock in Tennessee. That is what has turned our eyes westward, and there we have supplies much greater than those in the East. While the demand has not been such as to draw upon those supplies, we know that the time will come when they will be in demand. The phosphate areas of the West cover about 7500 square miles; that is the aggregate of the areas withdrawn. With regard to the need of the use of artificial fertilizers, there is no question among the agricultural authorities of this land. They agree that we have been gradually defaulting on our farms, and not only are we already in default, but we are adding to the deficit something like the equivalent of 5,000,000 tons of phosphate rock annually—more than is now produced in the whole world. There is a gradually increasing export of phosphate rock from this country, and there is promise of a greater increase. The Franco-German company is buying Tennessee phosphate land. They have a large paid-in capital, which is mainly held by French and Belgian interests, and they have already bought—I give this on the authority of a trade journal—16,000 acres in Tennessee, and are buying options on 10,000 more. That means that Tennessee phosphate is to go abroad, where they need it."

Frank Pierce, Assistant Secretary of the Department of the Interior, told the committee the condition of the claims that had been already patented in the Land Office, and then made the suggestion that Congress should pass some act which would keep the

phosphates within this country. He declared that this would best be accomplished by leasing the phosphate deposits, providing in the leases that there should be no exports of the phosphates, and also providing against monopoly. Mr. Pierce submitted to the committee a bill embodying this idea. In reference to the claims that had already been located, Mr. Pierce said that if these claims were originally located as placer claims, and were free from fraud, the Department was willing to issue patents; also, if the claims were originally located as lode claims, the Department was willing to issue patents to those locators for lode claims. He further suggested that each bona fide locator have the claims to his land as he located it sent to the courts for the ultimate determination as to whether it be lode or placer. If it be held 'lode', the placer applicant could not take it, unless he had claimed it as lode within a placer; if it be held 'placer', the applicant certainly will take it under a placer location or under a lode location (but without dip rights). Mr. Pierce referred to that clause of the bill which provided that no title to lands under the mineral lode laws shall give the locator any right beyond the perpendicular limits of his claim, and asked that it be stricken out. He said the bill treated of future locations, and classified them as placers, and that the general law provided that placer locations shall not have any extra-lateral rights. He said that if this was intended to refer to locations already made, he did not think that Congress ought to assume to take away the extra-lateral rights of a locator which are granted to him by the general mining law. He suggested that if the withdrawal of the lands was revoked, the lands be treated as though containing placer deposits.

L. E. Payson, representing the locators under the lode law, declared that a lode location was the only proper one. At this point Mr. Mondell suggested that, owing to the nature of the deposits, if a claim was patented under the lode laws, a locator, instead of getting 15 acres, might be getting 15,000 acres. Mr. Smith, of the Survey, made the statement that in Wyoming, near Nugget, the phosphate beds lie in such a way that the extra-lateral right would extend, possibly six or eight miles, up to a point where a fault cuts off the bed. Mr. Payson replied that the man who discovers the lode, puts his money into it, and commences to dig, ought to have the right to follow his dip, just as long as that vein is continuous, no matter if it goes down to the centre of the earth, if the heat would permit him to mine it. In answer to a question, Mr. Payson denied any knowledge of a fertilizer trust. He denied the power of Congress to amend the lode laws in such a manner as to cut off the extra-lateral rights, as this was a vested right. Mr. Pierce coincided in this by declaring that it would be an exceedingly unwise policy for Congress to pass any law that takes away any rights which the mining locator thinks, and has thought for over forty years, are vested rights. Mr. Payson ventured the statement that the proposition to prohibit the exportation of phosphate would have to meet a serious constitutional objection. The Constitution of the United States provides that there shall be no export tax or duty imposed on the exportation of the production of any State in the Union. In the Constitutional Convention there was an absolute unanimity of opinion that there ought not to be any interference with exportation from the United States of the products of any of the different States of the Union. While the provision was against the imposition of an import tax, he said that that was less objectionable than an absolute prohibition of exportation would be. If Congress has no power to impose an export duty on the products of any of the States, it clearly would not have the power to prohibit the exportation of such productions. The statement was made by Mr. Payson that the supply of phosphate outside the United States was absolutely illimitable and inexhaustible. Mr. Smith took issue with him on this point.

A. B. Browne, of Washington, D. C., representing the San Francisco Chemical Co., told of the claims held by his company under the placer mining law. He made a plea for the recognition of the first locator, whether of lode or placer, following the uniform rule and spirit of the mining law and industry, namely, to recognize the first in time as the first in right. He said that attempts had been made to jump the locations of the Chemical company by eleventh-hour men with lode locations, and suggested that for the future there should be such legislation as would eliminate the extra-lateral right. He asked that the future method of taking these phosphate deposits should be under the placer mining law. Mr. Browne quoted from a letter received from his clients to the effect that the several thousand tons of phosphate which had been sent abroad had been exported at a loss, and that exportation of this phosphate is not profitable after paying transportation charges of the rock for a thousand miles to the Pacific Coast in competition with the South Sea Islands in the Pacific. In conclusion, he said he was not present to antagonize the leasing system, but merely to urge that his people should be protected.

Benjamin Micou, of Washington, representing L. T. Brown, of Nashville, Tenn., who owns claims in Idaho, told the committee that Mr. Brown had entered his claims both as lode and placer, in order to protect them from claim-jumpers. He also asked that all locators, whether under the lode or placer laws, be protected. He declared that there were no vested rights in a mining claim until the claim is patented—in other words, there is no contract at all—and there is no constitutional restriction on Congress against passing a law changing the contract until after a patent is issued and title from the United States acquired.

The last one to appear before the committee was F. B. Weeks, of Washington, formerly of the United States Geological Survey, who declared that the largest phosphate fields in the world were in northern Africa, and that these fields will furnish phosphate to the world for many years—many centuries, probably. Mr. Weeks told the committee that phosphate mining in the West does not pay at present. "There is no question but that if a reasonable rate could be obtained to haul that material from the field

to San Francisco," said he, "and there make it into fertilizer, so that it could be shipped to Japan and Australia, there would be a profit. At the present rate there is nothing in it for anybody. If they build up an industry, it must be done by exporting it to Eastern countries for the next few years, or for a considerable number of years." A member of the committee asked Mr. Weeks if there was any danger of these mines being exhausted in the near future, providing the owners are permitted to operate them and export the phosphate. His reply was, "I cannot see any danger of it."

Since these hearings no action has been taken. The lands are still withdrawn, and a determined effort will be made to get remedial legislation from Congress next winter.

WIND RIVER PLACERS.

Written for the MINING AND SCIENTIFIC PRESS
By J. H. HASTINGS.

During the last few years numerous placer claims have been located on the Wind river, in Fremont county, Wyoming. This river rises in the Wind River mountains, and flows in a southeasterly direction for a hundred miles or more, then makes a big bend, and takes a due north course through the canyon which separates the Owl Creek and Copper mountains, into the Big Horn basin, there taking the name of the Big Horn river. Farther north it enters the Yellowstone river, in Montana.

The value and extent of the river gravel has not been determined by a series of thorough drill-tests, yet enough of such work has been done to indicate a dredgeable quantity of gravel in the bars and flats, with gold from 5c. to $1 per cubic yard. Several surface tests yielded results as high as $4.20 per cubic yard, but on account of barren strata the average to bedrock is reduced considerably. The depth to bedrock is about 16 ft., the same being either coarse sandstone or shale. These two sedimentaries occur in alternate layers in the Bridger formation, constituting the greater part of the plains in this district. The gold is very fine, except at the heads of some bars; one nugget was found weighing 0.003 oz. The colors, however, are not flaky, but exceedingly solid and pellety. The gravel consists of about 40% of stones never heavier than 30 lb., and the black sand makes 1% of the total. The following table of measurements was used in estimations made:

1 shovel	equals	10 lb.
2 shovels	"	1 pan.
300 "	"	1 cu. yd.
150 pans	"	1 cu. yd.
1 cu. yd.	"	3000 lb.

The weight of gravel per cubic yard was actually nearer 2700 lb., while the average shovelful falls short of 10 lb. On the other hand, a panful of gravel weighs 23 lb. However, the large quantities used for the tests ($^1/_6$ to $^1/_3$ cu. yd.) eliminate any possibility of great error. A Keystone drill will be used for the final tests, and the exact volume of the core can easily be calculated.

In making the laboratory tests of samples from a Keystone drill I found it expedient to part the mercury from the gold with concentrated nitric acid, which was more satisfactory than using a retort, as the small amount of gold obtained from $^1/_6$ cu. yd. was apt to be squeezed through the chamois with the mercury, and if by luck some was saved from this fate it was sure to stick to the bottom of the retort. The latter was placed in the small gasoline assay furnace, where it was impossible to keep down the temperature. Perhaps with more suitable equipment the retort method would prove efficient.

About 6000 acres of the gravel is now under option to capitalists. The workable gravel extends for 30 or 40 miles, from Boysen canyon to the Bend. The river is from 4 to 6 ft. deep and 75 ft. wide. The fall for the upper 20 miles is about 17 ft. to the mile, and gradually decreases to 7, increasing again to 32 while passing through the canyon. Ten months' operation for a dredge could be depended on, as the channel is only frozen over during December and January. A 60-ft. dam is being constructed at the mouth of the canyon, and it is the intention to erect a power plant during the year. This would furnish power for operation on the river. As the W. & N. W. railroad follows the river after reaching Shoshoni, there would be little difficulty in the transportation and installation of dredges. The Wind river placers afford good opportunity for further development of the dredging industry in this country.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

C. T. H., Goldfield, Nevada: Olivine basalt.

W. A. K., Prescott, Arizona: Actinolite schist.

E. F. J., Canon City, Colorado: Specular hematite.

A. F., Daggett, California: An aggregate of kaolin and talc.

J. M., Knob, California: A contact schist reddened by hematite.

F. T. W., Park City, Utah: Fine-grained hornblende schist.

C. H. F., Randsburg, California: Silicious dolomitic limestone.

R. E. H., McGill, Nevada: Specular hematite, epidote, and calcite.

J. M. N., San Francisco, California: Pyrite and chalcopyrite in a chloritic talcose schist.

L. N. W., Nevada City, California: No. 1, greatly weathered mica schist; No. 2, serpentine; No. 3, serpentine.

C. C. W., Cannonville, Utah: A sulphur-yellow to greenish substance which yielded a faint but distinct test for arsenic, a test for calcium, and a test for a third substance which was possibly chromium, possibly uranium. Aluminum also was suspected. The material was so extremely scanty and so difficult to separate cleanly from its matrix that no complete nor definite determination was possible.

Copper Production in 1908.

The production of copper in the United States in 1908 was 942,570,721 lb., according to a statement prepared by B. S. Butler which has just been given out by the United States Geological Survey. This is the largest production ever made, exceeding that of 1906 by 24,765,039, and that of 1907 by 73,574,230 lb., or 8.4%. In the following table the production for 1907 and 1908 is apportioned to the States in which the copper was mined. The total is made up of the fine copper content of blister produced and of the smelter output of ingot and anode copper from Michigan.

	1907.	1908.
Alaska	7,034,763	4,438,836
Arizona	256,778,437	289,523,267
California	33,696,602	39,643,835
Colorado	13,998,496	13,943,878
Idaho	9,707,299	7,256,086
Maine	.....	7,027
Massachusetts	.....	7,863
Michigan	219,131,503	222,289,584
Montana	224,263,789	252,503,651
Nevada	1,998,164	12,241,372
New Hampshire	.....	128,112
New Mexico	10,140,140	4,991,351
North Carolina	544,040	14,342
Oregon	518,694	271,191
Tennessee	19,475,119	19,710,103
Utah	66,418,370	71,370,370
Vermont	696,102	.....
Virginia	57,008	25,087
Washington	122,263	162,201
Wyoming	3,026,004	2,416,197
Maryland, Alabama, and Georgia[1]	90,655	
South Carolina,[2] Texas,[2] South Dakota[2]	.....	45,537
Missouri and unapportioned	1,299,043	1,580,831
	868,996,491	[3]942,570,721

[1]Georgia did not produce in 1908. [2]Not reported in 1907. [3]A portion of this total was reported by one company as electrolytic instead of blister copper. To compensate for the loss in refining there is added pro rata to the States concerned the approximate copper content of the bluestone recovered in the production of the electrolytic copper.

The following stocks were on hand at the beginning and end of the year:

January 1, 1908	125,745,796
January 1, 1909	121,876,759
Stocks decreased during 1908.	3,869,037

Undelivered sales are excluded from these figures. Stocks carried by consumers and brokers have not been ascertained. In addition to the stocks of refined copper there were at smelters, in transit to the refineries, and at the refineries, blister copper and material in process of refining to the amount of 175,254,659 lb. January 1, 1908, and 234,013,843 lb. January 1, 1909. The apparent consumption of refined new copper in the United States in 1908 was about 480,000,000 lb. In addition, probably 23,000,000 lb. derived from secondary sources entered into the year's consumption.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

ELECTRO-MAGNETIC ORE SEPARATION. By C. Godfrey Gunther. 8vo., pp. 193, Ill., Index. Hill Publishing Co., New York, 1909. Price $3.

This book includes a brief, clearly written, discussion of the principles underlying magnetic ore separation. The different types of machines in successful use are described and figured. Following this are chapters devoted to the concentration of magnetite ores, the separation of pyrite-blende ores, the separation of siderite from blende, and the separation of miscellaneous ores. In each case actual practice is described and many flow-sheets are given. It is to be regretted that more figures of cost and efficiency were not available to the author. In treating a process such as electro-magnetic separation where applicability, in the present stage of technology, can only be determined by trial, costs are, however, of less immediate importance than knowledge of the limits of the process. It might well have been pointed out, though, that installation rather than operating cost is important with this process in contrast with wet concentration. The author has done well in showing that the larger expense is incurred in preparing the ore for separation. The book is well written, accurate, and will be useful.

TOPOGRAPHIC AND GEOLOGIC SURVEY OF PENNSYLVANIA, 1906-1908. 8vo., pp. 375, Ill., Index. Harrisburg. 1908.

A brief account of the co-operative survey now being carried on by the State Commissioners and the U. S. Geological Survey, including the results of triangulation and primary traverse, and of spirit-leveling, with a list of topographic maps published, and a report of progress of the geological surveys, the latter written by George H. Ashley. Mr. Ashley's contribution is of interest as being the first general summary of the results of the new work. While necessarily a progress report only, it will be of large value to all interested in the geology and mineral resources of the northern Appalachian region.

PRELIMINARY GEOLOGICAL MAP OF THE PORCUPINE MOUNTAINS AND VICINITY. By F. E. Wright and A. C. Lane. Geological Survey of Michigan. Lansing, 1909. Price 25 cents.

This map of the region now being developed by the Calumet & Hecla will be appreciated by engineers interested in copper. It is a blue-print, scale about two miles to the inch. In addition to ordinary geographic features, the fault lines and geologic boundaries are shown.

PRODUCTION AND WASTE OF MINERAL RESOURCES AND THEIR BEARING ON CONSERVATION. By J. A. Holmes. Annals Amer. Acad. Pol. & Soc. Science. May 1909.

This pamphlet deals with the production of minerals, metals, fuels, structural material, etc., in the United States. It also gives figures on the amount that is wasted. It points out the increase in the use of these materials, the need for their conservation, and the steps necessary therefor.

CONGLOMERATE FORMED BY A MINERAL-LADEN STREAM IN CALIFORNIA. By Ralph Arnold and Robert Anderson. Bull. Geol. Society Amer., Vol. 19, pp. 147-154, Ill. New York. 1908.

AMERICAN MINING CONGRESS. First Report of the Committee on Prevention of Accidents in Metalliferous Mines. 8vo., pp. 16. Denver, 1908.

ABERDEEN-REDFIELD FOLIO. By J. E. Todd. Geologic Atlas of the United States, U. S. Geol. Surv., Washington, 1909. Price 25 cents.

INVESTIGATIONS RELATING TO ASPHALT. By Robert Anderson and J. A. Taff. U. S. Geol. Surv., Bull. 380-H, pp. 17. Washington, 1909.

INVESTIGATIONS RELATING TO SULPHUR AND PYRITE. By E. G. Wooodruff, U. S. Geol. Surv., Bull. 380-M, pp. 10. Washington, 1909.

INVESTIGATIONS OF THE COALFIELDS OF WYOMING. By J. A. Taff and others. U. S. Geol. Surv., Bull 341-B, pp. 282. Washington, 1909.

THE GENERAL ENGINEERING CO., Salt Lake City, Utah, has just published the second edition of its Ore Testing Bulletin. It illustrates the new and modern machinery which has been added to the already complete plant of this concern since the first edition was published. Numerous pages of 'mill notes and data', tables, and useful information, and like matter, make the pamphlet useful as a handbook.

COMPANY REPORTS.

UNITED ZINC.

The United Zinc Companies own nearly 4000 acres of well selected lands in the Missouri-Kansas zinc district. The corporation is one of the most substantial and conservatively managed of the Boston concerns which about 1900 became interested in zinc. The outstanding stock consists of 19,566 preferred shares of a par value of $25 each and 92,400 shares of common having a par value of $5. The decline in the price of spelter late in 1907 forced the company to curtail operations, and the year 1908 was an unfortunate one. The gross receipts amounted to only $59,268, of which $9778 was disbursed as dividends. The floating debt was, however, reduced and the liquid assets increased. In general, the resources of the company consist of ore in the ground. The policy of the companies has been to more than cover the depreciation in ore reserves from year to year by the purchase and development of new property, and to do this out of earnings rather than by means of new stock issues. In pursuance of this policy, during the past three years over $165,000 has been expended out of earnings in new land, mine development, and equipment, largely that of the Highland property, and in an investment in stock of the Lanyon-Starr Smelting Co. The Highland is a sheet-ground property near Duenweg. The development of this property and its milling equipment, which was recently damaged by fire, has cost in the neighborhood of $100,000. In the preliminary development work about 50 prospect holes were drilled, and in over 40 of them zinc and lead were found, all at practically the same level and proving the existence of a sheet deposit underlying the whole property. Three shafts have been sunk to the ore-level, two of them being single and one a double-compartment shaft. Over 1000 ft. of driving has been done and a breast of ore opened in good shape for mining in the No. 2 shaft. The mill now being re-built will have an hourly crushing capacity of about 40 tons. It is built in two sections. The slime department is complete. When the plant has reached its maximum crushing tonnage of 800 tons per day of 20 hours (it will take about four months after the plant is started before the mine will be opened so that this tonnage can be delivered economically), it will be productive of a large and uniform revenue for a great many years.

SHWELI DREDGING.

The Shweli Gold Dredging & Mining Syndicate, Ltd., of Mandalay, Burma, has extensive holdings of placer ground and water rights near Myitsone, in the North Shan States. The managing director, A. G. Blackwell, after visiting the dredging and hydraulicking fields of California, proceeded to the property to make plans for its development. The report of the company for 1908 is mainly taken up with his statement. Apparently the placers are extensive and workable, but as results of analyses on the concentrates made in the field were not available for the report, no final estimate of values is given.

CRESCENS.

The Crescens (Matabele) Mines & Land Co., Ltd., has large holdings in Matabele land, South Africa. Since the beginning of work, in May 1905, 25,734 tons of ore, yielding 14,965 oz. gold and a little silver, had been produced up to April 1, 1909. For the last year the mining has been done by tributors, and the profit for 1908 amounted to £4591, leaving a net remaining loss of £26,612. This, however, is not so bad, since it means that the company debt has already been reduced one-half. Since the company owns 531,234 acres of ground, it has large potentialities. It is managed by the Rhodesia Exploration & Development Co., Ltd., at Bulawayo.

ROBINSON.

The nineteenth annual report of the Robinson Gold Mining Co., Ltd., gives interesting details regarding the very prosperous work of 1908 at this great Rand mine. Since production began, the Robinson has yielded over £12,082,267 and the company has paid £6,549,687 in dividends. In 1908 the working profit was £1,007,006, and £825,000 was distributed as dividends, equivalent to 30%. W. W. Mein, who succeeded Sidney J. Jennings as consulting engineer, places the present ore reserves at 4,644,376 tons. Of these, 2,788,362 tons, being on the Main Reef Leader and the South Reef, are valued at 11.3 dwt. per ton. The remainder, on the Main Reef, are put at 4.75 dwt. He states that "there appears to be no marked tendency of the grade to change in any particular direction." Within the year 630,349 tons were mined, of which 18,193 were sorted out, the 210 stamps and 3 tube-mills treating 514,757 tons, with a yield of 315,690 fine ounces, equivalent to 12.265 dwt. per ton. The cost per ton was 12s. 6.7 pence.

VILLAGE DEEP.

The Village Deep, Ltd., in 1908 yielded 428,304 tons, of which 35,100 were crushed by the 180 stamps, yielding 26s. 8.98d. per ton, at a cost of 7s. 3.73d. A reduction in costs amounting to 4s. 9.7d. per ton was effected, with an increase in profits for the year of £52,058. The capacity of the treatment plant was increased and 23,823 ft. of development accomplished. The ore reserves are placed at 1,949,267 tons, valued at 5.58 dwt. per ton by W. W. Mein, consulting engineer. A dividend aggregating £106,067 was paid, and £149,149 carried forward.

FERREIRA.

The Ferreira Gold Mining Co., Ltd., is another of the Rand properties of which W. W. Mein is consulting engineer, succeeding Sidney J. Jennings. The Ferreira in 1908 did well. The development amounted to 1306 ft.; 339,014 tons were mined, 290,770 milled, and 282,669 given secondary treatment; 170,878 fine ounces of gold were won, at a working expenditure of 18s. 7.35d. per ton milled, and a profit of 30s. 10.48d. The total profits for the year were £448,848, and two dividends, each of 150%, aggregating £285,000, were paid.

Commercial Paragraphs.

The Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y., announces that it has secured the services of Franz J. Dommerque to represent it exclusively in an engineering and advisory capacity.

Fredk. C. Roberts & Co., San Francisco, agents for the Abbé Engineering Co., New York, advise that they have recently sold a tube-mill to the Florence Goldfield Mining Co., Goldfield, Nev. It is to be equipped with Ideal spiral feed.

The Keystone Placer Drill Co., Beaver Falls, Pa., is preparing a book on 'Blast Hole Drilling with Well Drills', which is to be published in connection with the 1909 edition of its Catalogue No. 4. The company will be glad to receive drilling records and general information along that line.

The Wood Drill Works, Paterson, N. J., is distributing a booklet called 'Glimpses of the Panama Canal', which is a non-technical review of the canal by Warren Wood and Robert J. Wood. It is a 16-page booklet, containing cuts of the Gatun dam, Culebra cut, the old Santo Domingo church, and other interesting sights. It will be sent to anyone interested.

Catalogues Received.

W. S. Rockwell Co., New York, in its Catalogue No. 4, describes and discusses its various styles and sizes of crucible melting furnaces.

The Milwaukee Locomotive Mfg. Co., Milwaukee, Wis., is distributing its catalogue of gasoline driven locomotives. It is called Publication No. 100.

The Cyclone Drill Co., Orrville, Ohio, in its Bulletin No. 2, just published, describes its line of small core drilling outfits, and gives complete net prices covering machine, tools, and equipment.

The Joseph Dixon Crucible Co., Jersey City, N. J., has issued a small pamphlet called 'The Proper Care of Belts', which contains many hints to those concerned with the proper running of power transmission belts.

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EDITORIAL.

STATE Geologists were not invited to meet the Director of the United States Geological Survey in conference at Washington this spring, as has been the pleasant custom of recent years. We are left in doubt whether their appetites or their criticisms were too keen.

AT the meeting of the Western Association of Technical Chemists and Metallurgists, to be held at Denver, July 2, Professor Robert H. Richards and his brilliant wife will deliver addresses upon metallurgical and chemical subjects in which they have won distinction.

FIJI is to have a Mines Department, and Mr. N. D. Cochrane of the Waitekauri Union Mines, and for seven years Inspector of Mines in New Zealand, has been offered the position of head. Discoveries of copper, lead, gold, and silver have been made, and sugar and copra may have to yield place to ores and metals as chief exports. When the truth is known to young Americans in all its nakedness, that the Fiji Islanders are liable to take out union cards, we doubt not that the South Seas will lose their attractiveness.

TARIFF tinkering goes on in the Senate, with speechmaking under the spot-light and trading in the wings. The House has passed one bill. In due time the Senate will pass another—and a painstakingly different bill. The Conference Committee will then evolve a third, which is likely to be of such strange physiognomy as to raise questions as to its parentage. Finally, if the President permits, the courts will take a hand, and in the course of some years we will discover, not whether Congress intended to revise up or down, but whether it did. In the meantime prosperity stands anxiously waiting for the cue. A delightful *fantoccini*!

OUR comments regarding the arrest of Mr. Edmund Juessen prove to have been especially well founded. In an official statement issued by the officers of the Pittsburg-Silver Peak Gold Mining Company it is pointed out that at the time charged in the indictment Mr. Juessen was not general manager. As consulting engineer he was not consulted about, nor did he have any connection with, the bullion tax returns, and he had no knowledge concerning them or their contents. It is a pleasure to call attention to this explanation. There are intimations that the whole affair was to cover a 'bear raid' on the stock, and Mr. F. Augustus Heinze is mentioned in this connection. It is not easy to get the whole truth at this time. Unfortunately, American financiers and company management are not always above suspicion, and the company involved has some active antagonists. We protest, however, against mining engineers being made the victims of financial games

and stock-jobbing enterprises. The technical advisers of a company should not be subjected to arrest for any such flimsy reasons as those assigned in this instance.

LOW-GRADE porphyry is a term which has gained such currency as to be bandied about today by the man in the street. In fact, it has become a fad, and to some extent a fetich, so that the promoter of the new breed of copper wild-cats must in future cease prating of veins which assay 20 per cent; he must discourse gravely of the millions to be won from the narrow margin in a 2 per cent ore. In truth, a 'low-grade porphyry' that shows 2 per cent copper is almost rising above the level of its class.

ON THE sixth day of July a test case to determine the constitutionality of the eight-hour law applying to mines and reduction works in California will be argued by Mr. Frank J. Solinsky before the Supreme Court of the State. Mr. Fred J. Martin, manager of the Utica mine, in Calaveras county, submitted to allow his attitude to become the basis for a contest which will set at rest conflicting interpretations of the statute. He violated the law in its three chief provisions, and was arrested on each separate count. The case will accordingly determine the validity of the law so that no question can remain as to the rights and obligations of the mine operators. The points which will be settled are primarily whether the limitation to eight-hour shifts will hold; secondly, whether workmen, employed on eight-hour shifts must go to and from their working places on their own time; and finally, whether the eight-hour limitation applies to quartz-mills as well as to other metallurgic reduction works. The complaints were filed on June 6, and the Superior Court declining to grant relief, the case was appealed directly to the Supreme Court.

REPEAL of the charter for the Metal and Mercantile Exchanges in New York is unequivocally recommended by the committee recently appointed by Governor Hughes of New York to report on Wall Street methods. The published market dealings on the Metal Exchange are not based on actual sales of metal. The report states that "prices are manipulated by a quotation committee of three, chosen annually, who represent the great metal-selling agencies as their interest may appear, affording facilities for fixing prices on large contracts, mainly for the profit of a small clique, embracing, however, some of the largest interests in the metal trade." In short, the metal market is arbitrarily controlled, thus affording to the manipulators the profits of a 'corner' without the risk of corralling the commodities. Governor Hughes is a practical reformer; he obtains data first, and frames his measures in the light of known facts. By appointing this committee, headed by Mr. Horace White, he commands the confidence of the world; and perusal of the findings of these men leads to recognition of the simple principle that a trust exists whenever the law of supply and demand is artificially disturbed, and that a remedy consists in prohibiting organizations, which influence quotations, from trading in the shadow instead of the substance.

Miners' Liens.

In our news columns attention is drawn to the case of the Confidence mine, in Tuolumne county, California, where the workmen have been left unpaid since December last. Other creditors have attached the property, and the miners affirm that they are left without remedy. Our understanding of the law does not agree with this hopeless view. A mechanic's lien takes precedence over other claims, and lies against the property itself, even when the ownership was not vested in the employer of the labor. It is for this reason that cautious lessors stipulate not only that lessees shall be solely responsible for labor debts, but even require deposits as guarantees of faithful performance in this regard, so as to prevent the possibility of clouding title. The alternative protection for the owner of a leased property is to post a notice on the property itself, disclaiming responsibility for labor debts. In Alaska it has been different, and complications have resulted. Gravel mining is usually continued through the winter, the gravel being piled in dumps against the spring clean-up. Dishonest and impecunious operators, disappointed in the amount realized, have from time to time defaulted in payment of wages. As a result, time-checks can only be cashed at ruinous discounts, wages have been high, and a bitterly contested strike had to be fought. James Wickersham, the present Delegate to Congress, has proposed a bill giving miners' liens for labor on dumps and gold dust, provided the claims are filed within ninety days after the completion of work. So long as the merchant is secured by liens it is certainly fair that the miner should enjoy the same protection, and Alaskans have already learned that failure to give adequate security to the men who handle the pick merely results in piling up costs and trouble. The law of compensation admits of no evasion in this or other particulars.

Investment in Mexico.

Refutation of peril to Mexican stability, political or financial, is afforded in a striking manner by the verdict of the moneyed men of New York in promptly taking the issue of $24,000,000 of 4½ per cent prior lien National Railways bonds, which were offered through the house of Ladenburg, Thalman & Company. These bonds were all subscribed at 95, and are now being traded in upon the floor of the Stock Exchange at about 95¼. No better answer could be given to the prophets of evil. Mexico is no longer a doubtful country; her government is established beyond fear of subversion; her financial policy is a model for the world; her banking system is more sound than that of the United States; and we could learn useful lessons in railroad control from the administration which has there been established under a representative commission, so constituted as to harmonize the diverse interests involved. Concurrently with the flotation of the new issue of prior lien railway bonds comes definite information of comprehensive railroad construction in the northern part of the Republic, closely linked with the development of mineral resources. Contracts are being let by the

Cananea Consolidated Copper Company for the building of a railroad across the Sierra Madre, giving the West Coast a northern outlet to the Mexican Central, passing on the way famous centres of silver production. This enterprise represents in effect one phase of activity related to the expansion of the International Smelting Company, whose influence promises to give a new direction to the metal market and to promote stability of production and prices. Coupled with this development under the initiative of Messrs. Thomas Cole and J. D. Ryan, is another equally important expansion of railroads in central and western Chihuahua, financed by Mr. F. S. Pearson and the powerful financiers associated with him. Meanwhile the Southern Pacific Company has opened its West Coast line to Escuinapa, 54 miles beyond Mazatlán, and the link between the eastern section in Jalisco and the present end of the track in Tepic is being closed as rapidly as the natural obstacles will permit. Information likewise comes of a new line from Guadalajara to the Pacific, traversing the important mining districts of Autlán and Ayutla, and also of an extensive system for developing the mineral resources of Oaxaca by the Mexican Southern railway, which has recently acquired the Taviche and the Oaxaca-Tlacolula lines. These are indices of the confidence of capital in the future of Mexico. Nothing so surely draws the purse-strings of investors as political insecurity, whatever be its nature. New enterprises in the United States are seriously retarded by the delay of Congress in passing the tariff bill. If there were financial or political difficulties threatening the course of Mexican progress, the sensitiveness of capital would be the first to detect it, and such investments as are being made today would be impossible.

Graft Prosecution.

Failure to obtain a verdict in the Calhoun case has distinctly set back the cause of civic betterment in San Francisco. Continued vacillation between right and wrong blunts the critical sense of the people. Procrastination in the administration of justice favors the growth of indifference to moral distinctions. Sharp, swift, decisive action is tonic. Such a bracer is needed. Can we obtain it? If so, how?

The recent trial was a flat failure. It is a dispiriting miscarriage of justice to have a case drag through weeks of acrimonious struggle, and in the end for the jury to show inability to weigh and judge the evidence like reasoning men. The jury certainly was at fault; its responsibility was shirked—a responsibility toward the accused, and another toward the public. The work of the busy city goes on apparently the same, and the people laugh. Nothing comes of these most serious charges against men conspicuous in the vital operations of the municipality; dereliction is therefore trivial, and civic duty becomes a matter of light regard. Under such circumstances the courts themselves lose influence; and the taint of weakness touches even the garments of the judge. If the matter be too weighty or tangled for the minds of jurors untrained in the law, then it were better either to give the prisoner the benefit of the doubt, or to return a verdict of guilty and thus permit the case, in its distinctly legal aspects, to be reviewed on appeal to a higher tribunal. We need authoritative legal utterances. The present course of things only cultivates civic obliquity, and creates a public sentiment which will permit a relapse into the political debauchery of the past.

The legal contest which has just been waged has been significant in its demonstration of the need of reforms which must sweep more widely than the narrow limits of municipal politics. The degeneration of our trial-system has been forcibly illustrated in the present instance. Instead of leading to an ascertainment of fact and of the law applicable thereto, the spectacle has been that of a *corrida*—a bull-fight, to speak plainly, where skill in the rules of the game, rather than the legal merits of the case, riveted the attention of court and people. It was a battle of wits, with the judge as umpire to see that the contestants kept from playing foul—and all the while the effort was 'to hit below the belt' when the umpire wasn't looking—or when he may perchance have been casting a far glance toward electoral influences. Here is an obstacle to the administration of justice which is as serious as those absurdities of court procedure which befog the issues presented to a jury. Judges generally accept a seat on the bench because it yields an income. Ideal civic or patriotic motives are often absent, however much they may sometimes animate the firmly seated occupant of the bench. Superior Court judges, being dependent upon election, and being human, feel the need of currying favor, of winning applause, and of dodging the perils of sitting as trial-judge over cases in which the enmity of powerful corporations may be incurred. The prevalent shuffling among judges to avoid this embarrassment shows to what pitiful shifts the supposed conservators of justice are driven in order to keep on a respectable footing with their own consciences. It is not often that the elective system for filling judicial positions brings forward men of such courage as Judge J. M. Seawell of the Superior Court of San Francisco. Under him we believe that the graft cases would have been disposed of swiftly and effectively.

The admission of irrelevant testimony confuses a jury, and affords excuse for failure to perform its duty. It opens the way to mis-trial, and defeats the ends of justice, whichever side be allowed to commit the error. Subsequent instructions by the judge to disregard irrelevant testimony fail to erase the impression made, not only of the testimony itself, but of the unfairness of its introduction.

All the defects to which we have called attention were exhibited in this trial. The defense rested on a cross-examination of the prosecution's witnesses, thus revealing the weakness of both sides. It is not possible to construe this into mere failure to show probability of guilt. The fault lies in the system, and the misuse to which it can be put. Until we improve the meting out of justice by a reform of court procedure, and by stiffening the backbone of the judiciary, only the rare circumstance of trying these cases before an absolutely fearless judge can give San Francisco the moral corrective that she needs.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

CHARLES BUTTERS is in London.

J. H. MACKENZIE is at Santa Cruz.

R. GILMAN BROWN is in West Africa.

W. C. THOMAS, of Salt Lake, is in Wales.

JULIUS W. HEGELER has been in New York.

ARNOLD BECKER was in San Francisco recently.

H. J. SHEAFE of New York is in San Francisco.

C. W. HAYES is expected in San Francisco July 10.

J. A. EDE is in the British Columbia zinc district.

H. C. HOOVER has returned to London from Korea.

F. LYNWOOD GARRISON is expected in San Francisco.

NEWTON B. KNOX is expected at London from Korea.

T. H. OXNAM, of Glendale, California, is at London.

ARTHUR K. ADAMS has gone to Huron, South Dakota.

C. K. LEITH will go to the Hudson Bay region in July.

EDWARD TOMARSON, of Pioche, Nevada, has gone to London.

J. P. IDDINGS has left for an extended trip through the Far East.

S. F. SHAW will be in Pioche, Nev., during July and August.

GEORGE ALEXANDER has returned to Kalso, B. C., from Europe.

F. G. STEVENS, of Etzatlan, Mexico, has been visiting Toronto.

W. E. GORDON FIREBRACE is at New York, on his way from London to Lima.

J. C. GWILLIM is at the St. Eugene mine, East Kootenay, British Columbia.

RALPH ARNOLD has been in the Coalinga and Santa Maria oilfields of California.

F. F. SHARPLESS is at Placerville, California, and will thence proceed to Nevada.

H. P. GARTHWAITE is on his way to Salvador, returning from a short visit to London.

H. H. WEBB and ALFRED VON DER ROPP left London on June 13, on their way to San Francisco.

W. G. ANDERSON has accepted a position with the El Favor Mining Co., at Hostotipaquillo, Mexico.

ARTHUR L. PEARSE is on his way to Juneau, Alaska, and expects to be at London early in August.

C. H. WILDMAN is superintendent for the Norwalk Mining Co., Ltd., at Michipicoten River, Ontario.

JUAN FELIX BRANDES has returned to Colorado from Europe. He will go to Mexico in the autumn.

A. C. LANE has resigned the position of State Geologist of Michigan to take a position in Tufts College.

G. S. SIMPSON, vice-president of the Butters Filter Co., has returned to San Francisco from a trip through Arizona.

W. J. ADAMS has been appointed consulting engineer for the Californian General Mining Co. of London and Paris .

WAYLAND H. YOUNG and JOHN PARR, of Oakland, have gone to Plumas and Sierra counties, California. They will go from there to Nevada.

S. E. BRETHERTON has returned to San Francisco from a trip to the properties of Friday & Lowden and the Afterthought Copper Co., of Shasta county, California.

P. C. JURS has been formally appointed manager of the mining machinery department of the Union Iron Works, San Francisco, a position in which he has been acting for the past four months.

GEORGE O. ARGALL has been appointed general manager for the Iron Silver Mining Co. at Leadville, Colo., in place of Waldemar Arens, deceased. Mr. Argall is a son of Philip Argall, and has for the past three years been connected with the company as mining engineer and assistant to Mr. Arens.

Latest Market Reports.

LOCAL METAL PRICES.

San Francisco, June 24.

Antimony	12—12¾c	Quicksilver (flask)	44—45
Electrolytic Copper	15¼—16½c	Spelter	6½—7¼c
Pig Lead	4.60—5.55c	Tin	32—33½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 17. £ s. d.	June 24. £ s. d.
Camp Bird	1 9 9	1 8 6
El Oro	1 6 3	1 6 3
Esperanza	2 16 3	2 16 3
Dolores	1 10 0	1 10 0
Oroville Dredging	0 13 0	0 13 6
Mexico Mines	6 0 0	5 16 3
Tomboy	1 2 6	1 2 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 18	13.25	4.35	5.45	52⅛
" 19	13.07	4.35	5.45	52⅜
" 20	Sunday.	No market.		
" 21	13 07	4 35	5.45	52¼
" 22	13.00	4.35	5.45	52⅜
" 23	13.00	4.35	5.45	52½
" 24	13.00	4.35	5.45	52½

MINING QUOTATIONS—NEW YORK.

	Closing Prices. June 17.	June 24.
Amalgamated Copper	80¾	82⅛
American Smelting & Refining Co	90⅞	91¼
Boston Copper	14½	14½
Butte Coalition	25½	25¼
Cumberland-Ely	8	8
Dolores	5	5
El Rayo	2⅛	2
Giroux	7⅜	7½
Greene-Cananea	10⅜	10¼
Indiana Sonora	3	3⅛
La Rose	7⅞	8
Miami Copper	16	15⅞
Nevada Consolidated	22⅞	23⅛
Newhouse	1⅝	1½
Nipissing	10⅝	10½
Ohio Copper	4⅜	4½
Tennessee Copper	39½	39
Utah Copper	50½	49
Yukon	4⅝	4½

(By courtesy of Trippe, Thompson & Co., 25 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. June 24.		Closing Prices. June 24.
Adventure	7½	Mohawk	65½
Allouez	43	North Butte	57¼
Arcadian	4¾	Old Dominion	53
Atlantic	9½	Osceola	134
Calumet & Arizona	103	Parrot	30½
Calumet & Hecla	652	Santa Fe	2
Centennial	32	Shannon	15¼
Copper Range	84	Superior & Pittsburg	14
Daly-West	17½	Tamarack	69½
Franklin	18	Trinity	11
Granby	101	United Copper Con	10½
Greene-Cananea, ctf	10¼	Utah Con	42
Isle Royale	26	Victoria	4
La Salle	13	Winona	5½
Mass	9	Wolverine	149

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, June 24.

Atlanta	$ 11	Mayflower	$ 9
Belmont	92	Midway	21
Booth	12	Montana Tonopah	66
Columbia Mtn	11	Nevada Hills	95
Combination Fraction	55	Ophir (Comstock)	1.45
Daisy	27	Pittsburg Silver Peak	48
Fairview Eagle	18	Rawhide Coalition	29
Florence	3.10	Rawhide Queen	35
Goldfield Con	7.55	Round Mountain	70
Gold Kewenas	9	Sandstorm	10
Great Bend	6	Silver Pick	11
Jim Butler	10	St. Ives	10
Jumbo Extension	12	Tonopah Extension	51
Llanos Con	75	Tonopah of Nevada	7.00
MacNamara	26	West End	23

General Mining News.

ALASKA.

(Special Correspondence).—The Bourbon dredge is now in charge of A. S. Grant, of the firm of Connor & Grant, who was formerly connected with the Butte and El Oro dredging companies at Oroville.——The Wild Goose Mining & Trading Co. is now starting its summer's operations. The first elevator was started on June 9, the second is to be started on the 11th, and two more within the next ten days. In the Nome district they are getting the Seward ditch in shape, and expect to have the water from the Nome river flowing through it about the 25th of this month. The season here is a little later than in the Council district. It does not pay to put the water into the ditches till frost is out of the ground. The snowfall last winter was less than the year before, but the summer water season seems to depend more on the distribution of the summer rains than on the winter snowfall.

Nome, June 10.

The stamp-mill erected by Ed. McConnell in the Bonnifield district is now running on quartz that will average over $12 per ton of free-milling gold. The concentrate is being sacked for shipment.

ARIZONA.

COCHISE COUNTY.

A fire in the Calumet & Arizona saw-mill near the Irish Mag shaft destroyed approximately $30,000 worth of property.

GILA COUNTY.

The Cactus Development Co. is to install a battery of 300-hp. boilers, a double-drum hoist, and a new compressor shortly. The Hamilton shaft is down 530 ft., with drifts run from the third, fourth, and fifth levels. Ore was cut at 220 ft. that averaged 2¾% copper. T. W. Hamilton is superintendent.——The Superior & Boston Copper Co. has recently paid $100,000 cash for the Collins-Doyle property. Frank H. Probert is consulting engineer.——The Arizona Commercial Copper Co. cut a body of native silver and copper on the 700-ft. level.——The McGraw shaft of the Superior & Boston cut a body of carbonate ore at a depth of 160 ft. that assays 9% copper.——At the Superior & Globe a shaft of three compartments has been sunk 330 ft. through the diabase. P. J. Wagener is in charge of the work with a force of 28 men.——A 4-stamp mill is being erected for the Single Standard company. Assays of the ore have run between $12 and $142 per ton.——At the Centennial mine, which is one of the oldest workings in the district near Cameron, sinking and driving is being done under the direction of W. M. Davis and Harry Zschoegner, who have leased the mine. The Centennial shaft is down 300 ft. and cross-cuts are being run from that point. The ore is copper and silver sulphide.——At a depth of 50 ft. in the A shaft of the Chrisman & Globe mine, a 10-ft. drift has been made, and ore has been taken out that runs $6 per ton gold, 5% copper, and carries some silver.——The National Mining & Exploration Co. has sunk the new Williams shaft 50 ft. in diabase. A hoist has been installed and the shaft will be put down to the 600-ft. level. A car of ore taken as a test shipment averaged 12% copper. F. A. Woodward is superintendent.——The shaft of the Orphan Copper Co. is down 1200 ft. and cross-cuts are being run on the fifth level. C. M. Clark is manager.——The Copper & Silver Zone mine has shipped $1700 worth of ore to the smelter since the first of the year.

MOHAVE COUNTY.

The claims of Grant McKesson in the Riverside Mountain district have been bonded to Los Angeles people.——The big dredging plant on the Colorado river near Eldorado canyon, is completed and turned over to the dredging company by the builders. It is expected that the first work of the plant will be done early in August, it being possible to work some of the gravel banks bordering the river by that time. When the river has resumed its normal condition the big pumps will be put to work on the bar and river bottom.——S. C. Bagg and associates, who have a bond on the Cyclopic mine in the Gold Basin district, have cut an excellent orebody 1000 ft. northwest of the old workings. The first lot of this ore that was taken out milled $29 per ton.——The first dividend of the Union Basin Mining Co., the only zinc company operating in the territory, has been declared for the 25th of this month. The property operated by this company is the Golconda mine, in Union basin. This mine has been developed 200 ft. in depth, and ships one car of ore per day to the smelter.

YAVAPAI COUNTY.

The Bokaritz Mining Co., operating the Etta mine in Cherry creek, has sent to the Prescott National Bank two bars of gold bullion worth $800.——The final payment has been made on the property of the Pittsburg-Mayer Mining Co. by F. E. Miller, of Pittsburg, Pennsylvania. The holdings of the new company comprise six claims, three miles east of Mayer in the Yavapai schist belt.——The Pocahontas Copper Queen Mining Co. has purchased a mill and is now erecting it at the Spar mine. The shaft is down 200 ft., with drifts and cross-cuts from the 100 and 200-ft. stations. W. H. Skinner is manager.——The Swiss Girl shaft of the Bauman Copper Co. is being re-timbered and will be sunk 500 ft. to the 1400-ft. level, from which point cross-cuts will be driven. Robert Campbell is superintendent.——The shaft of the Arizona-Utah Copper Co. is down 185 ft. and the vein cross-cut 20 ft. The ore assays between $8 and $10 per ton.

CALIFORNIA.

AMADOR COUNTY.

M. J. McDonald, who has operated the Keystone mine for the past 40 years, has sold that property to the California Consolidated Mines Co. This company is now operating the Wildman, Lincoln, and Mahoney mines at Sutter Creek, and will install heavier machinery and increase the working force at the Keystone.

BUTTE COUNTY.

The Boston machine shops at Oroville are being re-built and enlarged. The shops were partly destroyed by fire two years ago, and the dredging company had no occasion to hurry re-construction until now, when it is intended to commence the work of building another gold dredge across the river.——The Feather River Exploration Co.'s machine-shop is to be moved from Dredge to a new location in Thermalito.——The old Continental dredge, which has been operating for ten years, will be dismantled shortly, having been worn out in the process of extracting $2,000,000 in gold from the soil just outside the city limits.

CALAVERAS COUNTY.

The Plymouth Rock mine near Jenny Lind has been bonded to San Francisco parties. At present five of the ten stamps at the mill are dropping on $60 ore, which carries a high percentage of sulphide. The concentrate is shipped to the smelter.

NEVADA COUNTY.

A local branch of the Western Federation of Miners Union has been formed at Graniteville.——The trouble at the Idaho-Maryland has been adjusted and the miners returned to work. The drift in the east level has been run 300 ft. beyond all old workings, and the vein is from 12 to 15 ft. wide, 4 ft. of which is said to be high-grade milling ore. A raise from this level is up 90 ft., all in ore. This vein is in a territory never worked before by either the Idaho or the Maryland companies.——Martin Wallace has secured an option on several claims near Graniteville and is trying to interest capitalists to develop them.——The drain tunnel of the Gaston is in 2600 ft., with 1800 ft. remaining to complete the work. This will give 800 ft. backs on the main Gaston vein. This property is equipped with a modern 40-stamp mill. Claude Ferguson is superintendent.——The water has been lowered to the 500-ft. level in the Pittsburg.

PLACER COUNTY.

W. S. Fletcher is adding to the capacity of the mill at the Home Ticket, and doing other work preliminary to the development of the mine. The channel has been blocked out on a systematic scale and work can be crowded when the

taking out of gravel begins. All the channel thus far opened pays.——The gravel in the El Dorado has been getting richer as the drifts are advanced. Tom Haney has leased the channel along the adit in the lower lead of the El Dorado.——Wood & Young have struck a narrow but rich vein in the Dewey.——The Anderson mine at Duncan Ridge is taking out some excellent gravel. The company is starting a new tunnel.

SAN BERNARDINO COUNTY.

A 15-ft. vein was cut by a cross-cut on the 200-ft. level of the Oro Belle mine.——A 750-ft. adit on the Oro lease of the Big Chief company cut three veins of milling ore. These have been drifted on and a quantity of $8 to $12 ore blocked out. William L. Foster is manager.——Cross-cuts from the 100 and 200-ft. levels of the Jumbo property have cut a 15-ft. vein. A carload of this ore averaged $40 per ton.

SHASTA COUNTY.

The railroad depot at Iron Mountain, the saw-mill, timber-shed, and ore-bunkers at the railroad terminal were destroyed last week by fire. The Mountain Copper Co.'s loss will be close to $8000, partly covered by insurance.——A $2700 gold-brick was shipped to the mint by the Black Tom Mining Co. near French Gulch. Frank Eichelberger is manager.

SIERRA COUNTY.

H. L. Englebright and A. A. Charonnat have secured a bond on the Golden Star placer mine, situated in the Alleghany mining district.——A new 1200-ft. drainage tunnel is being driven at the Brandy City gravel mines. George F. Taylor is superintendent.——Work on the tunnel to tap the channel of the Secret Canyon Mining Co. has been resumed.——The Sixteen-to-One mine cut another rich portion of the ore-shoot in a raise. One thousands pounds of the ore is estimated to contain $50,000 in gold.——Two specimens were taken from the Rainbow mine that were valued at $1900.——The El Dorado Mining Co. has driven 40 ft. on the vein and the shoot is still high-grade.——A drift has been run 150 ft. along a 5-ft. vein of $20 ore in the Chipps mine.——There are between 35 and 40 men taking out gravel at the Bellevue mine, between St. Louis and La Porte. This is rich, but the ground being soft makes its extraction difficult.——The Sovereign Mines Co. owns the Papoose mine in Jim Crow canyon and the Soverign in Ladies canyon. At the Papoose a 15-stamp mill is running steadily on good ore. The vein is 10 ft. wide and is worked through a tunnel above which there is about 200 ft. of backs. A 10-stamp mill and compressor is to be installed at the Sovereign as soon as the machinery can be hauled in.——Frank Dillon has an option on the Comet mine. A 200-ft. tunnel cuts a 20-ft. vein which has been driven on for 300 ft. There is a 5-stamp mill on the property.

TUOLUMNE COUNTY.

The Confidence Consolidated mines, held under a lease and bond the past two years by Los Angeles people, with W. P. Cunningham part owner and manager, has closed down. The Electric Power Co., furnishing power to the mine, attached the pumping plant for power bills. The mine has not had a pay-day since December 1908, and the miners find the financial standing of the company in such shape that they cannot collect their wages.

YUBA COUNTY.

The new electric compressor plant at the Snowden Hill gravel mine above Camptonville is about ready to be put in operation. The pipe-line is nearly finished, and the dynamo set. The company is now engaged in building 500 ft. of sluices that will be used for washing the gravel, which is free and does not require milling.

COLORADO.

BRECKENRIDGE COUNTY.

The Wellington Mines Co. is keeping four teams busy hauling ore and concentrate from the property to Breckenridge for shipment. Besides shipping the regular output of zinc-bearing concentrate, the company is sending about 50 tons per week of high-grade lead concentrate to the Chamberlain-Dillingham sampler.——The Reliance dredge is now being repaired. A new bucket-line with two hardened-steel five-ton tumblers and ladderway are being put in. It is expected that about a month will be consumed in the work of putting the boat in good condition for a year's steady operation.

CLEAR CREEK COUNTY.

(Special Correspondence).——E. J. Butts has a big force of men at work on the Columbia and Eureka mines, situated on Silver mountain. The two adits are being cleaned out and re-timbered, and will be advanced to open new ground. In the upper workings there is exposed a streak of ore that is from 2 to 4 in. wide, and assays from 3 to 13 oz. gold per ton.——Oklun Bros., owners of the Scott property on Republican mountain, sent a shipment of 20 tons of silver-lead ore last week and received a settlement of $43 per ton.——Work is under way in the Sporting Times property on Alpine mountain. A. H. Colburn, the owner, has started cross-cutting east from the Moore vein to intersect the Sporting Times vein. Driving will be resumed upon the Moore vein on a streak of ore that is from 6 to 8 in. wide and runs about 2 oz. gold, 14 oz. silver, and 61% lead per ton.——A carload shipment of smelting ore was made last week from the Gold Quartz property at Alice, and returns of $30 per ton in gold were realized. W. A. Maxwell is manager.——The Lombard mill is crushing from 40 to 50 tons of ore daily, and a clean-up of the plates made the first of this month resulted in nearly $9000 gold. H. I. Seeman, of Denver, is manager.——The electric plant of the Two American Sisters M. M. P. & E. Co. has been leased to the Georgetown Power Co. for a period of five years. Wires have been strung to Empire and electricity is being furnished to the residents and mine operators of that place. J. F. Eidy is manager.

Georgetown, June 19.

GILPIN COUNTY.

The electric plant at the Perry mine of the Oak Hills Coal Co. is now ready for regular operation, 5000 ft. of heavy transmission line having been hung underground. Two motors have been placed on the tipple to handle the cars as they come up out of the mine, and the small hoists and coal-cutting machines will be operated by electricity.——The A. K. R. Gold Mining Co. has cut the ore-shoot on the lower level of the Smuggler mine. The stamps are dropping on ore that mills about $20 per ton, with a concentrate that is worth from $50 to $90 per ton. G. M. Ashmore is manager.——The Gilpin Mining Co. has resumed work on the Little Gold Dirt mine at Gilpin.——A force of 10 lessees in the Perigo, near Rollinsville, is taking out a good deal of milling and some smelting ore, the latter running about $50 per ton at the sampling works. The milling ore is stored and the mill run on lots of about 1000 tons. The concentrate runs about $45 per ton.——The Sherman & Macon Mining & Milling Co., operating in Silver Creek, have shipped a lot of ore to the Chamberlain sampling works during the past week, as well as to the Fifty mill in Black Hawk, both lots being for test purposes to enable them to ascertain the content of the vein which they recently cut in the tunnel workings.——F. A. Burnell, of Denver, has made arrangements to run the ore taken from the Luella B. mine on Perigo hill through the Daisy mill. A 5-ft. vein has been opened on the property by two shafts, 130 and 70 ft. deep.

OURAY COUNTY.

The Ouray Mining & Milling Co. has commenced work on its Highland Chief and Fredonia mines. S. O. Rickard is in charge of the work.——A new pipe-line for water-power has been laid to the mill at the American Nettie mine.——The raise being made from the level of the main working tunnel of the Thistledown mine on Mt. Hayden to the ore-shoots encountered in the upper workings has cut good ore for the last 30 ft. Two shoots of ore have been cut by this raise.——Work has been started on the Gray Hound group near Ironton.——The Pony Express is shipping high-grade ore regularly.

TELLER COUNTY.

The Elkton Consolidated Mining & Milling Co. announced the regular bi-monthly dividend of 1c. and an extra divi-

dend of ½c. for June 24.——Four sets of lessees mining ore from the surface deposit on the Four Queens and White House claims of the Stratton's Independence, Ltd., estate on Battle mountain loaded several teams last week for the valley mills. This surface ore is reported carrying gold from 1 to 7 oz. per ton.——A car of ore was shipped by the Victor-Colorado Mining Co. from its lease on the Rigi mine on Battle mountain.——Lessees are shipping ore from the Papoose Gold Mining Co.'s Guess claim on Squaw mountain. The ore is being mined from the May B. vein.——The north half of the Four Brothers lode mining claim on Beacon hill has been purchased by Willis B. Cauble, of Peoria, Illinois, one of the directors of the Iowa Mining & Leasing Co.——A shipment of two cars of ore from the Deadwood mine of the United Gold Mines Co., mined at the 250-ft. level, was made last week, and the returns received were on the basis of $26 per ton.——Operations on company account have been commenced at the No. 1 shaft of the Dante Gold Mining Co., and the mine will shortly be re-equipped with a modern mine plant. The company has purchased a powerful 10 by 14-in. hoist and will equip the shaft for a two-ton skip.

IDAHO.

BLAINE COUNTY.

The Comet group in Scorpion gulch has been recently purchased by J. George Arkoosh of Bellevue. The vein has



Map of Idaho.

been traced for 1000 ft. on the surface, and 600 ft. of 'backs' shown by lateral work. The average assay returns have been lead 76%, silver 120 oz., and gold $16 per ton.

IDAHO COUNTY.

The Elk City Dredging Co. has purchased the Golden Seal and Golden Seal Extension placer claims on the American river and have started construction work on a dredge. I. B. Hammond, of the Hammond Construction Co., will have charge of the work.——A saw-mill is being erected on the Buckhorn group of mines on Thunder mountain and later a 3-stamp mill will be installed.——A new shoot of ore has been cut on the property of Charles J. Shadduck near Orogrande.

OWYHEE COUNTY.

A 6-ft. vein with a 2½-ft. pay-streak was cut by the adit of the Berg mine at Rooster Comb. H. B. Benson is in charge of the work.——A 15-ton mill has just been completed by E. S. Stuart for the Gold Crown mine at Oreana. ——A 50-ft. shaft has been sunk on the vein of the Gold Nugget mine and a 40-ft. cross-cut run to intersect a parallel vein. C. M. Sweatland is in charge of the work.

SHOSHONE COUNTY.

On 28 tons of ore in a recent shipment from the H. E. M. mine, near Wallace, the smelter assay was lead 55.2%, and silver 18.1 oz. per ton. Russell F. Collins is directing the work.——The cross-cut tunnel on the Great Northern Co.'s mine near Burke has been driven 400 ft., and has cut chlorides assaying 14 oz. silver for the last 80 ft. Ed. Eisman is manager.——Twenty-six inches of rich galena ore has been struck on the 600-ft. level of the Corrigan mine, belonging to the Federal Mining Co., west of Wardner. Beside the solid ore there is a large quantity of milling ore.

MICHIGAN.

The Wyandot has opened the new 35-ft. amygdaloid lode cut by the exploratory cross-cut east at the 700-ft. level, from the hanging wall to the foot-wall. This lode lies considerably over 1000 ft. east of the older workings in the Winona lode, and well into the horizon of the so-called Lake lode.——Operations in the Caldwell shafts of the La Salle Co. continue with rather discouraging results, and in all probability one of these shafts will be abandoned and a new shaft started farther north in the direction of the Tecumseh shaft of the company, where first-class copper ground is being opened at several levels. The other Caldwell shaft will be deepened in an effort to get out of the shattered zone in which both are opened.——The New Baltic Exploration Co. has completed the first diamond-drill hole and has rigged up 500 ft. to the westward, where a new hole is being put down at an incline.

NEVADA.

CHURCHILL COUNTY.

Another strike was made in the Gold King Co. mine at Jessup on the 150-ft. level. The ore is of the picture-rock variety. On the Mohawk claim the rich shoot is opened for 60 ft., and the Ellis lease No. 1 is in 2 ft. of ore carrying a high percentage of horn and ruby silver.——The White Canyon Mining & Milling Co., under the superintendency of Joseph Mackedon, is encountering some very rich showings on the 200-ft. level, where a cross-cut has been run 28 ft. to cut the vein.——The Stewart Mining & Leasing Co. has resumed operations under the superintendency of A. D. Le Roy.

ESMERALDA COUNTY.

The output of the mill of the Goldfield Consolidated Mines Co. has been increased 35 tons per day.——The Great Western mine at Hornsilver has changed hands and will be reopened shortly. The company will install new machinery and develop the mine on a larger scale.——A 5-stamp mill is being erected for the Mammoth Mining Co. on Gold mountain. P. Jubien is president of the company.——The blowing in of the smelter at Luning has done much to revive that district.——The Luning Gold Mines Syndicate, under Robert B. Todd's management, shipped a carload of high-grade ore. ——The old Hidden Treasure, under the title of the Nevada Silver Leaf Co., is being developed again. J. H. Hartwick is manager.——The Lotta is being opened again after several years idleness, by George I. Wright.

HUMBOLDT COUNTY.

The winze 100 ft. from the portal of the adit of the Seven Troughs Trio Co. cut a body of ruby silver.——The Florence lease is still in an excellent body of silver ore.

LANDER COUNTY.

(Special Correspondence).—The Austin Manhattan Co. is actively pushing work on its holdings, and before winter expects to be producing on a large scale. The cutting of a station at the junction of the main tunnel and the Frost shaft is progressing rapidly, and later on the Lander Hill shaft will be opened to the lower levels. The party of

Austrian-Swiss engineers who recently examined the mine express themselves well pleased with the showing, and it is likely that the property will be taken over by the people they represent.——Colvan & Co. have opened a rich shoot of ore at a depth of 100 ft. in the Roosevelt claim. Assays run from $40 to $150 per ton.——Active work has started at the Patriot mine, which was formerly a good producer. ——At the Grand View a gasoline engine and other equipment is being installed. Good ore has been opened and the management is preparing for active work on a large scale. ——Considerable prospecting is going on in this district, several old properties are being re-opened, and the camp generally is more animated than for some time past.

Austin, June 19.

LINCOLN COUNTY.

The adit of the Rives mine cut the old workings of the Fetterman and disclosed an excellent orebody. The vein was exposed in the Fetterman for 200 ft.——The Atlanta group at Silver Park has been bonded to Elmer Bray, R. S. Baverstock, and M. D. Rochford. The property is a low-grade ore and will be worked on a large scale.

NYE COUNTY.

The output of the quicksilver mines at Berlin in Ione valley is 600 lb. of mercury per day.——The placer operations in the Manhattan gulch during the past week show a continuance of the rich pay gravel, and a number of new shafts have been started for bedrock. On a majority of the properties electric power will be used.——The shaft of the Morning Star cut a 2-ft. vein at a depth of 125 ft. that assays over $30 per ton.——On Union No. 9 all machinery has been ordered for equipping the Lamb lease with a 75-hp. electric hoist, air-compressor, and pumps.——A new strike has been made on four claims located by C. F. Smith, which are situated four miles southwest from Milletts. The property has been bonded to Nels Paulsen, manager for the Lehigh-Antelope Leasing Co. It has a vein from 10 in. to 2 ft. wide, and assays taken on the surface for a distance of 200 ft. run from $20 to $186.

STOREY COUNTY.

The Golden Gate mine is being re-opened under the management of Heber Holman. Machinery is being installed and the shaft will be sunk 600 ft. to the level of the Sutro tunnel.

WHITE PINE COUNTY.

The cross-cut from the 1000-ft. station of the Giroux shaft has been driven 750 ft., and a raise started for the five-compartment shaft. The company will start sinking from the surface and will sink and raise from the 700 to connect with the workings from the 1000-ft. level and the surface. Four drills are being run to prospect the ground round the Bunker Hill shaft.——The Nevada Consolidated is now cutting for a new top bench at Copper Flat. This cut is taking it near the top of the hill.——At the Cumberland-Ely the drill on the Puritan has been closed down temporarily. The Veteran mine production is keeping up, and such development work as is being carried on is giving good results.——The Ely Central is to prospect its ground with churn-drills. O. A. Turner is president of the company.——The Boston Ely has stopped cross-cutting the 800 and is sinking to the 900-ft. level, where they will again start cross-cutting.——The Coppermines property is confining its work to churn-drill exploration.

NEW MEXICO.

GRANT COUNTY.

At Silver City last week the Manhattan-Asiatic-Aztec group of mines of Pinos Altos was sold to satisfy a judgement. The property was bid in for $36,000 by Bernard Greenfielder, of St. Louis, representing Nathan Frank and Sidney Rothschild.——A Boston syndicate, headed by Francis E. Young, has bought the Cleveland group of mines, eight miles north of Silver City. George H. Utter, the owner, received $300,000 for the property. The Cleaveland ore is copper and zinc.

LINCOLN COUNTY.

The Commercial Metals Co. is about to develop an extensive deposit of ore on the west slope of the White mountains, six miles southwest of Carrizozo. The company has a large body of copper-lead ore.

M'KINLEY COUNTY.

The Crescent Oil & Land Co. has shipped drilling machinery from Oklahoma for use on its claims eighteen miles northeast of Gallup.

SOCORRO COUNTY.

The Top mine in the Mogollon district has been sold by the Top Mining Co. to a syndicate which will organize the Top Development Co. The Top has a 270-ft. shaft and lies between the Last Chance and the Confidence mines.——At the Little Fannie mine of the Socorro Mines Co. a cyanide and amalgam plant has been installed, power for which is generated from a fall 12 miles away. The mill at present is treating 60 tons per day with an extraction of 89%. A new 150-ton mill is being built, as well as a 600-kw. hydro-electric plant.

OREGON.

BAKER COUNTY.

The Hammond Pony Dredge at Gold Center is ready for operation. It is mounted on a turntable 14 ft. diam. carried on an eight-wheel car. The machine revolves through a horizontal angle of 90° when in operation, making a cut 50 ft. wide at the bottom. The buckets are 2 cu. ft. capacity, and the speed is 20 to 30 buckets per minute.——A contract has been let to drive a 250-ft. adit on the Gold Coin property in the Greenhorn district.

GRANT COUNTY.

The Dixie Meadows Mining Co. has started its mill near Prairie City after five years idleness.

JOSEPHINE COUNTY.

A new corporation has been organized in Grants Pass called the Old Glory Mining Co., with C. L. Mangum as president. The property is situated on Silver creek, 20 miles west of Galice, in the vicinity of the recent rich discovery of Brazill and Robinson on the same creek, and consists of four lode and two placer claims.——The Greenback mine, 20 miles north of Grants Pass, which was shut-down a year ago, is soon to be put in operation again by its old superintendent, Cary W. Thompson, who has taken a bond and lease on the property, and will work it as soon as the mine can be re-timbered and some dead work done. There is a 40-stamp mill on the property and a first-class cyanide plant. This mine has paid to the shareholders $1,200,000.

UNION COUNTY.

John Hughes, of Susanville, has sold the Ophir property in the Summerville district to Thomas S. Kennersly and Edmond R. Willets, of Trenton, New Jersey, for $50,000. A shaft is down 180 ft. and the new owners intend to sink another 100 ft. and drift on the vein.

UTAH.

BEAVER COUNTY.

A car of ore shipped from the Cave mine was settled for on the basis of 17.5% copper, 5 oz. silver, and $2 gold per ton.

JUAB COUNTY.

Two cross-cuts are being run on the Sioux Consolidated property. One of these is being driven toward the east from the 450 and the other is headed toward the original territory of the Sioux from the 200-ft. level. The mine ships about 14 carloads of ore per week.——At the Centennial Eureka mine the work of cutting out a station upon the 2260-ft. level has been completed and drifts will be run from that point. The mine is shipping about 45 cars of ore per week. R. A. Rrown is superintendent.

SALT LAKE COUNTY.

Five cars of ore will be the total amount of ore shipped by the Bingham Central Standard property this month. A portion of this comes from the Mountain Maid tunnel.—— The Alta mine is to be re-opened under the direction of R. J. Jarvis. The adit will be run to cut the lead-silver vein on the property.

WASHINGTON.

FERRY COUNTY.

The McKinley Mining Co. is shipping from its property in the Orient mining district. The ore is being mined from a 7-ft. vein.

CANADA.

BRITISH COLUMBIA.

The contractors have commenced the task of deepening the shaft from the 900 to the 1200-ft. level of the Josie mine of the Le Roi No. 2 Co.——The Centre Star group of the Consolidated company continues to yield a good tonnage of ore, the output for the week being 3690 tons. The War Eagle is developing in a satisfactory manner, the latest find being the uncovering of an ore-shoot on the eighth level. The surface of the Enterprise is being prospected as a preliminary to underground explorations from the levels of the Idaho.——On the I. X. L. an adit is being driven along the vein and the high-grade shipped to the smelter.——A large shipment of silver was made from the British Columbia Consolidated Co.'s smelter at Trail to Hong Kong, China, comprising 54 bars which averaged 1025 oz. each. The silver will be refined for the Hong Kong & Shanghai bank at Hong Kong. There was about $55,000 worth in the consignment.——The Alberta Railway & Irrigation Co. is erecting a big steel tipple and installing heavy machinery at No. 6, a new mine, situated about four miles from Lethbridge. ——At the Corbin mine, on the south fork of Michel, the entry is in a big mass of coal, up to 160 ft. in thickness. The main tunnel is in 1200 ft., and 300 tons of coal is being shipped daily.——The St. Eugene is producing between 500 and 600 tons of lead-silver ore per day, nearly all of which is concentrated in the mill.

An $8000 gold brick was brought to Nelson from the Nugget mill during the week. This represented a 20-day run at the little mill. An English mining syndicate that is driving a tunnel on the Bell property is making an effort to secure the Lucky Shot claim at Phoenix. A strike is reported from the Rambler, West Fork, assays taken on the vein showing that it carries 980 oz. silver per ton.——At the Phoenix Amalgamated property of the Consolidated company work has been started on the tramway that will carry ore from the mine to ore-bins at the railway siding. The force at the Snowshoe mine of this company has been increased and shipments will be somewhat heavier in the future.

The 5-drill compressor, boiler, and engine of the Iron Cold Mining Co. has been purchased by the Inland Empire Co. and will be installed at the mine. It is the intention to sink to the 300-ft. level on the vein and drift till there is sufficient ore blocked out to warrant the building of a reduction works. S. F. Griswold is manager.

ONTARIO.

The King Edward mine cut a 3-in. vein of silver ore in a raise from the 150-ft. level.——An 8-in. vein of silver ore was intersected by a cross-cut from the 65-ft. level of the Silver Cross mine at Cross lake.——The Blackburn mine northeast of Miller lake has opened a number of leads on the surface and has started sinking.——The Paymaster mine at Sasaginaga lake has cut three veins in the cross-cut from the 115-ft. level.——The La Rose Consolidated Co. has acquired the Lawson mine. A double-compartment shaft is being sunk to the 80-ft. level to connect with the Silver Leaf.

QUEBEC.

J. E. Hardman, of Montreal, was in Thetford recently looking over some asbestos ground.——The Montreal fiscal agents of the Compton Gold Dredging Co. having failed to make good on their agreement to provide funds for a dredge by May 1, Kennedy & House, of Beebe, are now calling for the return of their property, as other parties are ready to take it up and put on a dredge this season.——It is reported that the Eustis people are about to re-open the nickel property at Brompton lake.——The asbestos merger and the sale of some prospects has caused the prices of asbestos property to advance beyond their normal value.——The Eastern Canada Smelter Co., which has an option on J. McDonald's copper mine in Weedon, is sinking a new shaft.——The Nichols Chemical Co. of Capelton is making important changes in its nitric-acid plant.——The John Armstrong farm, about two and a half miles east of Danville, has been leased to a party associated with F. T. Savoie, of Plessisville, who will prospect it for asbestos.

MEXICO.

JALISCO.

The Moctezuma Mining Co. is now being organized in the States to re-open and develop the old Argentina mine in the Ayutla district. Juan M. Quintero, of New Orleans, and James H. Lowes, of Indianapolis, Indiana, are among those interested in the new enterprise.——The St. Joe mine, near the town of Ayutla, has been sold by Louis C. Frey, Jr., to G. M. Anderson, of Montana. The mineral land amounts to nine pertenencias, and the ore is copper-silver.

MEXICO.

The Compañia Mexicana de Petroleo 'El Aguila', South America, has been formed with a capital stock of $25,500,000 to acquire the concessions for the development, exploitation, and marketing of native crude and refined oils, as well as other kinds of oil products held by the firm of S. Pearson & Son, Ltd., Oil Fields Department. The company is headed by Governor Guillermo de Landa y Escandon, as president. The concessions secured by the new company cover all the holdings of the Pearson Oil Fields Department north and west of an imaginary line drawn about 19° longitude west from Washington and extending from Veracruz in an almost direct line south to Puerta Angel, on the Pacific Ocean and in the State of Oaxaca. It includes the Dos Bocas field and such rights as the house of S. Pearson and Son, Ltd., acquire by contract from the Oil Fields of Mexico Company.

NUEVO LEON.

At a recent meeting of the stockholders of the Cia. Carbonifera Agujita, the report for the year 1908 showed a decrease in the coal output, but an increase in the coke production. There were 200 ovens working continuously.

OAXACA.

E. P. Keevil, owner of rich mica deposits in the State of Oaxaca, has gone to the City of Oaxaca, where he will take personal charge of his interests.——Agents of the Westinghouse company, it is said, are at present in the Republic with the intention of purchasing mica lands. The General Electric Co. has already purchased valuable deposits.

SONORA.

(Special Correspondence).—The May production of the Greene Cananea Copper Co. was 3,851,796 lb. copper, 85,000 oz. silver, and 506 oz. gold. The blast-furnace treated 50,638 tons of charge exclusive of coke, and the reverberatory 7222 tons, of which 5780 tons was flue-dust. The blast-furnace charge was made up of 18,680 tons of first-class ore, 20,430 tons of concentrate, and 3200 tons of reverberatory and blast-furnace matte with the fluxes and chips. During May all the reverberatory matte was sent to the blast-furnaces, and a portion of the blast-furnace matte was re-fed. This month no blast-furnace matte has been re-fed. The complete costs for May are not yet out, so that it is not known whether the experiment of re-feeding a portion of the blast-furnace matte was successful or not. The concentrator handled 67,896 tons of ore during the month. The coke consumption for awhile has been down to 8% of the charge, which is unusually low, running as a rule above 10%. The June production will be not over 3,500,000 lb. of copper. For the first ten days of the month only four furnaces were in blast; since then five, and the sixth will be added in a few days. The average production for the first 15 days of June was 49.6 tons of copper. The reason that only the four furnaces were in operation the first part of the month was because the ore reserve on the spreading beds was too low, but is now well ahead again. At present there is a larger percentage of concentrate on the spreading beds than formerly, averaging about 45%. The concentrate, which is classified separately for the two groups of mines, runs about as follows: Cananea Consolidated, 6% copper, Cananea, 9%, with a ratio of concentrate for the respective groups of ores of three into one and six into one.

Cananea, June 19.

Special Correspondence.

MEXICO.

North Mexican Trunk Line.—Cole-Ryan Building Railroad.—Pearson Interests.—Southern Pacific Extension.—Guadalajara-Chamela Road.—National Railway Bonds.—Matamoras Bridge.

It has been announced by L. D. Ricketts, general manager for the Cananea Consolidated Copper Co., that the company will begin construction at once of a railroad through the northern part of the States of Sonora and Chihuahua, Mexico. The Mexican Government has granted the Cananea company four concessions for the construction of the road, the sections being as follows: (1) From Del Rio, near Cananea, east to a point on the line between the States of Sonora and Chihuahua, touching the international line at Agua Prieta opposite the city of Douglas, Arizona; (2) from Del Rio to Imuris, a station on the Sonora railroad; (3) from the point where section No. 1 ends on the Sonora-Chihuahua line to a point on the Rio Grande, Sierra Madre & Pacific railroad at or near Guzmán station; (4) from Guzmán station east to a point on the Mexican Central railroad. The new road is to be constructed in a substantial manner with 80-lb. rails and with ties and timber creosoted. The line will run through the Sierra Madre, giving means of transportation for a large quantity of timber, the demand for which is good throughout the entire southwestern mining region.

For some time there have been rumors of the contemplated construction of a large custom smelter at Douglas by the Cole-Ryan interests. This new railroad, which will run through Agua Prieta, just across the international line from Douglas, adds to the probability of such a smelting plant being erected, although nothing has been stated by Dr. Ricketts in relation to it. An advertisement for bids by contractors is published in the Bisbee and Douglas papers, stating that "under concessions from the Government of Mexico the Cananea Consolidated Copper Co., S. A., is building a railroad across northern Mexico. Bids are requested on grading of same. For full particulars, profiles, specifications, directions for bidding, and other information, apply at the office of the company at Douglas, Arizona."

As previously noted, the Pearson interests have taken control of the Chihuahua & Pacific railroad, which is a necessary link in the Kansas City, Mexico & Orient line to Topolobampo in Sinaloa. The present terminus of the C. & P. is at Tomósochic, whence the Sierre Madre & Pacific prolongs communication to Madera in the heart of the great range, not far from the celebrated mines of Batopilas. The latter road, now in the grasp of the Cole-Ryan group, was located through the initiative of that fallen idol of Sonora and Arizona, W. C. Greene. The titles to the holdings forming part of this enterprise were recently investigated with great care by Walter Gow, of Toronto, Ontario, who is a vice-president of the Mexico Northwestern Railway Co., and attorney for that corporation. He was assisted by Luis Rivas y Cervantes, of Mexico City, and Joaquin Cortazar, of Chihuahua.

Work on the Southern Pacific branch road (Cananea, Rio Yaqui & Pacific) is progressing at a rapid pace. The town of Acaponeta, Tepic, was reached on June 15, and the rails will reach the great canyon of the Santiago (or Lerma) river by August. It is stated by William Hood, chief engineer, that a 1% grade may be adopted, which will increase the cost ₱8,000,000. That would indicate a determination on the part of the Harriman interests to dominate the carrying trade of northwestern Mexico. Low operating costs on the main trunk line to the Plateau industrial, and smelting centres, will admit of diverting traffic by branch lines from the western slope of the Sierras. The last section accepted by the Government was from Mazatlán to Escuinapa, 87 kilometres, making a total of 855 kilometres from Guaymas (530 miles), on which the cash subsidy has amounted to ₱10,687,500.

The Kansas City, Mexico & Orient railroad is making its best showing on the eastern end of its line, but the mountain section in Mexico is languishing. The gap there is only 75 miles in length, but it involves the most formidable construction, with a great many tunnels. It is estimated that the cost will be $100,000 gold per mile.

A new railroad company has been organized by French and English capitalists to construct a line from Guadalajara, the capital of Jalisco, to Chamela. Governor Ahumada has announced that the State will give a subsidy of ₱4000 per kilometre. The road will connect with the Ameca branch at La Vega, and will provide the Ayutla and Autlán mining districts an outlet, and at the same time will open a rich agricultural region. This would give Guadalajara a third rail route to the Pacific, and it is believed that it will constitute a valuable feeder for the Government 'merger system.'

The National Railways have just issued, through Ladenburg, Thalman & Co. of New York, $24,000,000 prior lien bonds, bearing 4½%, ranking ahead of the $160,000,000 authorized general mortgage 4% bonds, which latter are unconditionally guaranteed as to principal and interest by the Mexican Government. The prior lien bonds constitute part of the total authorized bonded indebtedness of $225,000,000, of which $89,225,077 has already been issued. The railroad earnings in Mexico have been steadily increasing, the net product on the State-owned and State-controlled lines exceeding $2,000,000 per month. C. R. Hudson, vice-president of the National Railways of Mexico, states: "Business generally over the Republic is looking up, and in all the years I have been in Mexico, I have not met in such a short time so many people, both from the United States and Europe, as are now here looking for investments. It seems to me that they can find them all right, on account of the diversity of what we have within the borders of the country."

The International Railway bridge at Matamoras is now being constructed, the site having been agreed upon between the engineers of the Mexican road and those of the St. Louis, Brownsville & Mexico on the American side of the line. The selection of Brownsville as the site is considered as conclusive evidence that the Gulf Coast railroad line to Tampico has definite prospects of earlier construction. It is believed that the latter line will be constructed by Harriman interests, and in the same connection it is rumored that the Harriman people will bear a portion of the expense of the construction of the Brownsville bridge.

LONDON.

Briseis Tin.—Ringarooma.—Oroya-Brownhill.

The report of the Briseis Tin & General Mining Co. for 1908 shows that the life of the Briseis tin mine in Tasmania is going to be rather longer than was originally estimated. At one time it was feared that the gravels would be exhausted by the end of 1908, but it has since become certain that there is enough left for the whole of 1909, and perhaps for a third of 1910 as well. The year's output was 768 tons of metallic tin from 1048 tons of black tin, which were recovered by washing 435,100 cu. yd. of gravel. The other property, 'No. 1', which is worked by the Briseis company for other owners, yielded 252 tons of metallic tin from 346 tons of black tin produced by washing 104,200 cu. yd. of gravel. Of this output the owners of 'No. 1' took 106 tons, and 146 tons went to the Briseis company. Consequently the latter company sold altogether 914 tons of metallic tin during the year, which was very near the figure, 910 tons, in 1907. The receipts were £121,814, as compared with £151,222 in 1907, relative figures which show at a glance the fall in the price of the metal. The net profit, after allowing for depreciation, taxes, etc., was £58,360, and £45,071 was brought forward from the previous year. The dividend distributed in 1908 was £60,000. The other properties belonging to the company are the adjoining Ringarooma and some new gold gravels in Victoria. Of the Ringarooma, the directors unfortunately have to say that systematic sampling has given vague results. During the year work has been confined to removing the overburden, and before long it is hoped to make a start on washing the tin gravels underneath. It will then, by working on a

large scale, be possible to tell what they are worth. Prospecting on the gold gravels in Victoria has yielded fair results and the options have been exercised.

The Oroya-Brownhill mine in West Australia is another example of a mine lasting longer than was expected. It will be remembered that this big producer suddenly fell off owing to the nature of the ground quite unexpectedly changing. At one time there seemed little hope of the ore lasting longer than the end of 1908, but later on it was announced that it would be possible to maintain a regular output until June of this year. More recent advice shows that it is probable that the life of the mine may be extended until the end of the year. During 1908, the mill treated 122,855 tons and the yield was 40,595 fine ounces, the average being 28s. per ton, while the working costs were 17s. 10½d., which is a reduction of 1s. 10d. as compared with the previous year. In addition to such ore reserves as are left, the company also owns some 500,000 tons of old slime residue which is being worked over again by a new slime plant. About 20,000 tons per month are being treated in this way. The extraction is estimated at about 5s. 9d. per ton, and the expenses 2s. 2d. per ton, so there is a total profit in sight of nearly £80,000. The other leases taken over in the neighborhood by the company do not appear to be promising well at all, and the hopes of the company are now centered on Central America. C. S. Herzig has been in that country and has acquired the La Leonesa mine in Nicaragua and has also obtained a favorable option on the Babilonia mine in the same State. These two properties are opening up well and the shareholders should feel fairly comfortable. So also should Herbert C. Hoover, who, as managing director of the company, has had the responsibility on his shoulders of finding a new property.

WASHINGTON.

Zinc Tariff. — Coal Imports. — Petroleum Production. — Oil Lands.

The zinc schedule of the tariff bill has at last been settled by the Senate, after a most spirited contest. As it passed and as it will undoubtedly appear, it is as follows: "Zinc-bearing ore of all kinds, including calamine, containing less than 10% zinc, shall be admitted free of duty; containing 10% or more of zinc and less than 20%, ¼c. per lb. on the zinc contained therein; containing 20% or more of zinc and less than 25%, ½c. per lb. on the zinc contained therein; containing 25% of zinc or more, 1c. per lb. on the zinc contained therein. Zinc in blocks or pigs, and zinc-dust, 1½c. per lb.; in sheets, 1¾c.; in sheets, coated or plated with nickel or other metal or solutions, 2c.; old and worn-out, fit only to be re-manufactured, 1c. per lb." The schedule proposing a duty on petroleum has not yet reached the Senate. The Finance committee has, however, reached an agreement which provides for a duty of ¼c. per gallon on crude oil and 25% on the refined, and probably on petroleum products. The duty on bituminous coal has not been definitely agreed to, but the rate will probably be at 50c. per ton. The duty on slack or culm will be 15c., as under the present law, but there will be provided a definition of what constitutes natural slack, and only that grade of slack will be admitted under the lower rate. The House made the duty on coal 67c. per ton, without reciprocal arrangement. The need for the amendment defining slack was explained to the Senate the other day by Stephen B. Elkins, of West Virginia. It seems that in loading the Nova Scotia coal into the railroad cars it dropped from an unusual height. This broke up the coal considerably. Then, in unloading it into the boats to take it to Boston, it was passed through a tube 60 ft. long, with breakers. This also broke up the coal, so that by the time it reached Boston it would nearly all pass through a half-inch screen, and therefore most of it was set down as slack and paid only 15c. per ton.

The production of petroleum in the United States in 1908 has just been given out by the United States Geological Survey. The total production aggregated 179,572,479 bbl., valued at $129,706,258, an increase in quantity of 8.11% over 1907. Oklahoma led all the States in production, with a total of 45,798,765 bbl., an increase of 5.23% over 1907; California was a close second, with 44,854,737 bbl., an increase of 12.85%; but Illinois gained the greatest percentage, rising from 24,281,973 bbl. in 1907 to 33,685,106 in 1908, a gain of 38.72%. Colorado, Louisiana, Michigan, Missouri, Utah, Wyoming, and West Virginia also showed gains in production. The losses were in Indiana, Kansas, Ohio, Texas, Pennsylvania, New York, Kentucky, and Tennessee. The average price of petroleum for the entire country in 1908 remained identical with that in 1907, but there were considerable variations in individual States.

Jonathon Bourne, Jr., of Oregon, has introduced in the Senate a bill providing for the disposal of lands chiefly valuable for oil. The bill provides that any citizen or association or corporation may file a declaration that he or they intend to explore for and develop the oil in a tract of land not exceeding 160 acres. No entry shall thereafter be received for this land for two years unless the claim has been abandoned or cancelled. The provision is contained in the bill that if there are any veins or lodes of quartz or other rock or placer-bearing gold, silver, or other valuable deposits known to exist at the date of filing application for patent, title shall not pass under this act, but such minerals are expressly reserved and shall be subject to location and entry by any qualified person under the provisions of the United States mining laws.

GOLDFIELD, NEVADA.

Consolidated Refinery.—Florence.—Goldfield Daisy —Fraction.

A. H. Howe, of the Consolidated Mines Co., denies a purported interview with him lately published in New York, in which he was quoted as saying that the high ore extraction in March was the result of a series of mistakes in sending to the mills ore the value of which had not been ascertained by sampling. It is explained that in opening up the Hampton stope in March, ore was found with which no experiments had been conducted. This ore averaged $190 per ton, but the mill-heads were kept down to about $60 by mixing in ore of lower grade. The tellurium in this orebody renders it refractory to milling, and a large portion has been shipped to the smelters. The Consolidated company's refinery is now outputting bullion bars at the rate of over $17,600 daily, and the mill-heads are being maintained at $35 per ton.

The extent of the latest find in the Engineer's vein of the Florence mine has not yet been determined, but the ore is exceedingly rich, carrying free gold and gray copper, in jasper. Some of the assays have run over $60,000 per ton. It is the intention of the Florence managers to explore the vein at greater depth than the present deepest point, 500 ft., upon the completion of the main shaft. Within three weeks the new equipment will have been installed in the Florence mill, which will then have a capacity of 160 tons daily. During May the Florence produced 3353 tons of ore, with a gold recovery of $33,500. The Goldfield Daisy is now being worked on a profitable basis, and it is the intention to increase the shipments of smelting ore. In a lease on the Daisy and adjoining the Great Bend a small vein of rich ore has been exposed at a depth of 250 ft. In sinking the Victor shaft of the C. O. D. Consolidated the vein has been cut below the 400-ft. level, and production will shortly be resumed. The ore carries a high percentage of gray copper in addition to gold. The Combination Fraction mine is maintaining its regular output of 80 tons daily, and the mill is said to be making a satisfactory recovery. Two bars of bullion from this mill were sent out recently, valued at $16,000. On the Goldfield Merger Mines Co.'s claims three leases are in good ore. Driving will be resumed at 200-ft. depth on the lease of the Combined M. & L. Co. The Kansas City Velvet has a good vein of rich ore, which has shown some improvement with recent development.

In the eastern part of the district sinking has been resumed and extensive work outlined on the Nancy Donaldson. A hoist and head-frame have been installed and some good ore found in the vein at a depth of 100 ft. This group of claims is on the Red Mountain mineral belt, and ore assaying over $3000 per ton was found near the surface. No

deep work has been done at this point. It is announced that work will be resumed on the claims of the Diamondfield Red Mountain Co., where there are large deposits of mill ore exposed. Near the town of Diamondfield work is now in progress on the Goldfield Eureka, the Goldfield Apex group, and on the Goldfield Retter. On the Laguna, lessees are developing at a depth of 718 ft. from the Hazel Goldfield shaft. Another deep shaft is to be sunk on the Poleverde claim, owned jointly by the Consolidated and Jumbo Extension companies.

BUTTE, MONTANA.

Boston & Montana —Badger State.—Butte Coalition. — Colorado. — Gilsonite Discoveries.

The signs of the times on the Butte hill point to prosperity. From the financial crash of two years ago, when all work connected with the production of copper was materially curtailed, the mining activity of the district is slowly but surely recovering. One of the most encouraging facts given out by J. C. Adams, manager of the Boston & Montana properties, is that the mines under his control are now shipping more ore than at any previous time in the history of the company. Whereas a short time ago the monthly output was only 110,000 tons, it now is 140,000 tons. Three thousand five hundred tons daily are being shipped to the Boston & Montana smelter at Great Falls for treatment, and approximately 20,000 tons per month are being shipped to the Washoe smelter at Anaconda. With the enlargement of the Great Falls plant which is to be made in the near future, it is probable that the capacity of the plant will be so increased that the entire tonnage from the B. & M. properties here may be handled there. Work at the Badger State mine has been started again under the most favorable auspices, and the shaft, which is already 1200 ft. deep, will be sunk to 1800 or 2000 ft. The head-frame which formerly was at the Minnie Healy has been removed to the Badger State and erected, and the flat-rope, double-reel engine formerly at the Mountain View mine has been installed. This gives the Badger State excellent equipment, and work will be pushed as rapidly as possible. The Tramway property of the Butte Coalition Co. is now hoisting 750 tons per day, and the ore is running from 3 to 5% in copper. The Tramway has one of the finest surface plants in the country, electricity being utilized extensively and all of the most modern labor-saving devices being in evidence. The engine is of 20 hp. The entire plant was erected at a cost of $360,000. The Minnie Healy is being operated through the Tramway shaft, the 1300, the 1400, and the 1500-ft. levels having been already opened up.

At the Colorado mine of the Davis-Daly Estates Copper Co., where the shaft is being sunk from the 1485 to the 2000-ft. level, 5 ft. of 5% copper ore has been found. It is also stated that an excellent and apparently extensive body of ore has been cut into on one of the lower levels of the property. The Colorado is now employing 100 men and is hoisting about 100 tons of ore per day. If the good fortune of this company continues it will be able to open the basin concentrator before the time set, some time during the early winter. The surface plant has been entirely changed, and consists of a 60-ton head-frame and a 22-drill Nordberg air-compressor. The sinking and much of the development is being done by contract, and some record drives have been made in the property during the past few months. The property is situated in the heart of the city, and because of that is somewhat short of surface ground. A retaining wall is being built to remedy this feature in a measure. It is stated that the gold in the ore being sent to the Washoe smelter at Anaconda is sufficient to cover the cost of transportation.

An extensive deposit of gilsonite has been discovered on Redwater creek in Dawson county, Montana, by J. B. Holloway. Mr. Holloway and two associates have secured control of all property contiguous to the new find, and have already been offered a large sum for their interest. Gilsonite is only found in commercial quantities in the United States in the Uinta basin.

SALT LAKE, UTAH.

Fink Smelter. — Ohio Copper. — Mascotte Tunnel. — Knight Mines Sale.—Tintic Production.

The test that was to have been made with blister copper in the Fink furnaces was postponed by reason of a break in the temporary blowers that have been installed. During the week arrangements will be made for this demonstration in the presence of Samuel Newhouse, E. A. Wall, and some metallurgists. Several successful runs have been made on Boston Con. concentrate, and in converting a matte that carries from 65 to 80% copper. E. P. Jennings and Frederick W. Scofield, both metallurgists of high standing, have witnessed demonstrations of the Fink furnaces in the interest of New York and European capitalists. They have no hesitancy in saying that the Fink method will be successful in making copper matte at a low cost. A permanent smelter, constructed on the Fink lines, with a few mechanical alterations, is now being considered by Mr. Newhouse and some capitalists of this city and New York. This plan may not be carried to a successful conclusion for several months, as it is the desire of those who are to become financially interested that Mr. Fink first make some further experiments with his blower. It has been Mr. Fink's idea at all times to smelt the ores without the assistance of any foreign material, and in a measure he has unquestionably been successful. It is now proposed that tests be made with lead ores from the mines at Alta and other districts, using fluxes.

Ohio Copper will have its mill in commission some time in August. This is the report given out by Frank Jones, who has charge of the construction work. The first unit will have a capacity of 500 tons per day, while the entire plant will be capable of treating about 2500 tons. It differs from both the Utah Copper and the Boston Con. plants, having rolls for crushing, in place of Chilean mills and Nissen stamps. The mill will be under the supervision of William Kidney, of the Heinze staff at Butte. The Mascotte tunnel has been driven a distance of 13,900 ft. into the mountain, and is within 100 ft. of the Ohio Copper and Utah Copper end-lines. At a point 13,500 ft. from the portals of this tunnel an incline is used to carry supplies and men to the various workings. The principal work is now being done on the third, fifth, and seventh levels. A raise is being made from the tunnel level along the ore-shoot. This will connect with the various levels. A chute will be put in and the ore dropped to the tunnel to be hauled to the mill. The mine is opened up into ore blocks 100 ft. square. It is estimated that there is enough ore now in sight to last 20 years, and the sulphide zone on the hanging-wall side of the mountain has not been explored.

The Mascotte tunnel is to be the main thoroughfare for transporting the ores from Bingham mines. It is owned by F. Augustus Heinze, and is one of his principal assets in Utah. He will extend it into the Utah Copper and Boston Con. territory. It will cut the former at a depth of 800 ft. below the present steam-shovel workings, and the Boston Con. at a depth of 1600 ft. From these properties it is planned to extend the tunnel 13,000 ft. through West Mountain range to the ore-bins of the International Smelting Co. plant on the opposite side of the range, in Pine canyon. Branch tunnels under the various mines will make possible a great saving in transportation charges. It is believed that this will be accomplished within a couple of years.

Since Jesse Knight has been in New York a number of statements have been given out relative to the proposed sale of the Colorado and Iron Blossom mines and the Tintic Smelting Co., all of which Mr. Knight controls. From one who is interested in the deal it is learned that the sale will involve something like $6,000,000. The three large smelting companies are mentioned as the probable purchasers. Colorado is to be put in at $2,500,000, Iron Blossom at $2,000,000, Tintic Smelting Co. at $1,000,000, and the Tintic railroad to the mines at $380,000. The mines are silver-lead producers, each paying monthly dividends of $80,000. The smelter has 4 lead and 1 copper furnaces, of a capacity of 225 tons each. Should Mr. Knight dispose of these holdings, it does

not mean that he would retire from the mining business. He has a controlling interest in a score of other properties that are being developed, but the Colorado and Iron Blossom are his principal producers. Tintic mines are now producing about 6000 tons of ore each week. Almost half of this amount is being mined in the Centennial-Eureka, owned by the United States Smelting Co. This mine has been one of the largest producers in the State for a number of years. It has copper-silver-lead ore, and at a depth of 2260 ft. driving is now being done both ways in ore. Operations have been little hindered by water, the pumps handling the water easily at this great depth.

JUNEAU, ALASKA.

Mining Resumed.—Auk Bay Discoveries.—Alaska Treadwell.—Eagle River.

The mines of Silver Bow basin have resumed operations for the summer season. The great depth of snow and the lateness of the spring season will make this year's run short. The Perseverence mill is dropping 100 stamps, and the company is employing about 150 men. The Alaska Juneau mine has resumed operations under the superintendance of L. K. Kennedy, and a successful season is anticipated. The Ebner mine is still idle, pending the closing of some important deal. There has been considerable excitement in this district over the discovery of some good looking prospects at Auk bay, about 12 miles northwest of Juneau. Both placer and lode claims have been located, and while nothing has been proved as yet, the outlook is good. It is reported that the ore is similar to that of Silver Bow basin, and exists chiefly as quartz stringers in schist. Every launch and rowboat in Juneau has been pressed into the service of the prospectors and all the ground for miles around has been located.

During the year ending May 15 the mills of the Alaska Treadwell Gold Mining Co. crushed 768,628 tons of ore with an average assay value of $2.57. The average number of machine-drills at work in the mine during the year was 39, drilling 28½ ft. per shift and breaking one ton for every 0.96 ft. drilled. In the 240 mill the 900-lb. stamps crushed an average of 4.79 tons per 24 hours per stamp. One pound of steel in the shoes crushed 3.06 tons of ore, and one pound of iron in the dies crushed 4.79 tons. In the 300 mill the 1050-lb. stamps crushed an average of 5.34 tons per stamp per 24 hours. One pound of steel in the shoes crushed 2.40 tons of ore, and one pound iron in the dies crushed 5.61 tons. It has been decided to install a central power plant at Treadwell to generate electric-power for the lighting, pumping, and other purposes where its application will be more economical than that now in use. The first installment of the plant will consist of two Westinghouse-Parsons steam turbines, direct connected to two 750-kw. 1000 K. P. A. generator units. Work on the new dam at the head of Bullion creek will be pushed this season, and it is hoped that its full capacity will be available when the water begins to be short this fall.

The Eagle River Gold Mining Co., managed by B. L. Thane, is employing a force of 45 men and operating a 20-stamp mill on Eagle river, 25 miles northerly from Juneau. The mine and mill are seven miles from the company's wharf on Lynn canal, a surface tramway of that length serving as a means of transportation. The mine is on a belt of ore that strikes northeasterly, on a contact of granite on one side, and slate and schist on the other. Within a belt that ranges from 50 to 100 ft. wide there are two systems of ore-shoots, one adjacent to a limestone and slate hanging wall, and the other along a foot-wall of altered diorite. The black slate between contains several ore-shoots. These are 40 to 100 ft. long, and 2 to 20 ft. wide, and pitch northeasterly. The gangue is quartz, containing free gold, arsenical pyrite, stibnite, galena, zinc-blende, pyrrhotite, chalcopyrite, and bornite. The property is developed through a vertical depth of 1000 ft. by 10 levels, some of which are cross-cuts and others are drifts on the ore. All levels are connected by raises, the lowest level, 1400 ft. long, being connected with a 2000-ft. aerial tramway, over which the ore is sent to the mill. All levels, drifts, cross cuts, and raises aggregate 17,000 ft. of work. The mill, having twenty 1000-lb. stamps and six Willley tables, has been operating since April 1904, and during that period about 70,000 tons of ore have been milled, running, approximately, $10 per ton. About 90% of the total extraction was made on the amalgamating plates, the concentrate product running $50 to $100 per ton in gold, silver, and lead. Eagle river is a glacial stream that heads in Herbert and Eagle glaciers, flowing down Eagle valley into Lynn canal. The government wagon-road and trail, which it is proposed to build from Juneau to Eagle river, will aid prospectors and explorers in their efforts to make locations and develop claims on the mineralized belt extending along the coast range parallel to Lynn canal. This road-building is to begin July 1. Its further extension from Eagle river to Berners' bay is a part of the plan outlined. From Eagle river north to Berners' bay, a distance of 20 miles, many mineral locations have been made.

BRITISH COLUMBIA.

Eva Mine.—Slocan Zinc.—Silver to Hong Kong.—Copper Costs.—New Dominion Re-organization.—Western Canada Power.

The Eva mine at Camborne has been bonded by American capitalists. This property is well equipped with machinery, there being a modern air-compressor and power-plant on the ground, as well as a 10-stamp mill and concentrator. There is a large tonnage of low-grade gold ore in the mine; it being possible on some of the large surface lodes to work on the 'glory-hole' plan. The mill was put in about five years ago and worked steadily up to a year ago, when it was decided to sell the property. During the period that the mill was in operation about $250,000 was produced in gold bricks. That the Slocan zinc district is a factor in the fight now being waged at Washington is evinced by the presence here of J. A. Ede, of the Illinois Zinc Co., who is studying the local situation. T. F. Noon, general manager for the company named, has been in Washington protesting against the proposed zinc tariff. Another one of the regular shipments of silver that the Consolidated smelter at Trail has been making to banking institutions at Hong Kong was sent on its way last week. It comprised 54 bars of the white metal 0.999 fine and was valued at about $55,000. The silver is used for coinage in the Orient. The Trail refinery is also furnishing the Dominion Mint with metal. Work has not yet been resumed at the mines of the International Coal & Coke Co., Coleman, and as a consequence the British Columbia Copper Co. is still without a supply of coke for its smelter. The fifth annual report of the International company shows that the net profits for the past fiscal year were $284,210. The company recently sold 200,000 shares of its treasury stock, the proceeds of which will go toward paying off the bonded indebtedness. The British Columbia Copper Co. has been mining, smelting, and converting its copper at a very low figure during the last year, but a record low cost price was made during the last month of operation when the product of the plant was landed in New York at 7.96c. per pound. The lowest cost that had been reported prior to the above was 10c. per pound. The British Columbia Copper and Granby companies can now make copper at as low a cost as most copper mines on the continent. They have installed labor-saving devices in and around both mine and smelter. The orebodies of this district are big, so that large quantities can be broken at once.

It is expected that the property which the Hayden syndicate bought in at Vancouver will now be turned over to the New Dominion Copper Co. and securities issued, as was stated at the outset of the re-organization proceedings; that is, that the new company will issue $500,000 in 6%, ten-year income bonds, and 250,000 shares of common stock, par value $5 per share, the present bondholders to be paid in stock to the amount that the company is found indebted to them, while the bonds will be disposed of to the old shareholders and others in order to raise a working fund. Word comes from London that financial arrangements have been completed for the carrying out of a big plan of development

at the Le Roi mine, Rossland. The plan is to thoroughly prospect the depths of the mine with diamond-drill from the 1650 to the 2650-ft. level.

Last week the interests of the Stave Lake Power Co., near Vancouver, were absorbed by a new $5,000,000 company, the Western Canada Power Co., which expects within 18 months to be able to deliver 30,000 electrical horse-power to this district. At present there are about 60 men employed constructing the dam and plant, but a much larger force will be put to work almost immediately in order to hurry the work. Great progress is being made at the group of claims owned by the Portland Canal Mining Co. near Stewart. Two of the tunnels are being driven and raises run from them, while a new tunnel has been started. Towers are being built for the aerial tramway.

DENVER, COLORADO.

Electric Power.—Clear Creek. — Portland Mill. — Petroleum.

The Colorado & Southern railroad is preparing to electrify its South Park, Clear Creek, and other mountain lines, and part of its Denver terminals. John F. Stevens, late vice-president of the New York, New Haven & Hartford, is expected here soon to make an official report on the project. Plans have about been completed for the construction of a plant at Mill Gulch, on the South Platte. The South Platte Power Co. is the name of the corporation that is preparing to construct the plant. H. C. Jahl, an electrical engineer from the East, is in charge of the power project. The plant is expected to generate 20,000 hp., and will cost approximately a million dollars.

In Clear Creek county the usual summer activity has begun. A contract was awarded this week by the Mammoth M. & M. Co. for the sinking of the shaft on the Mammoth vein an additional 50 ft. This will make the total depth a trifle over 200 ft. This property lies in East Argentine, and from the present workings high-grade ore has been mined. Previous to the suspension of work last fall the shoot was lost, but it is planned to start driving east and west in an endeavor to discover the same. The Humming Bird M. & M. Co. has purchased the Big Chief lode, situated on Lexington mountain. Work has been put under way in the repair of the old workings, and everything will shortly be in condition for the extraction of a large body of ore that is now exposed. Richard Staley of Idaho Springs is manager. Moonan & Oxley have taken a lease upon a block of ground on the 1000-ft. level of the Lamartine mine.

At Cripple Creek work will shortly commence on the construction of the Portland G. M. Co.'s mill. The site selected is midway between No. 2 and No. 3 shafts, on the northeast slope of Battle mountain. At Colorado Springs good success is reported in raising money for the drainage tunnel. It is said that the subscriptions now made assure the completion of the work.

Petroleum is attracting considerable attention now in Colorado. T. G. Brice, superintendent for the Lime Creek Oil Co., operating in the San Juan county, Utah, field, reports considerable activity in that section. The oilfield is now beyond the prospective stage, and heavy rigs are being installed and every preparation being made to market the oil now ready to ship. A pipe-line has been projected and will be laid to the railroad, a distance of about 75 miles, and plans are also drawn for a local refinery. The Lime Creek Oil Co. owns 2080 acres of land in the heart of the proved oil territory, and has two good wells drilled. One of these is in the first sand and showed oil at a depth of 200 ft. The second well was sunk into the second sand, and now has 400 ft. of oil standing in the casing. This well was a gusher, and had to be capped. Cripple Creek men are interested in the new field, and the Fisher Oil & Land Co. was incorporated in Denver this week. The Fisher company owns 320 acres, and the incorporators and officers of the company are D. C. Williams, Charles Fisher, and W. L. Turner. Petroleum has been several times reported from the southeastern part of Colorado, also, and it is possible that an oilfield exists there. It is expected that R. D. George, State Geologist, will make an examination this season.

LOS ANGELES.

Independent Pipe Line.—Coalinga Drilling.

The most important recent development in the oil situation is the completion of the organization of the independent producers' pipe-line company which took place in Bakersfield Tuesday, June 15. Such a project has been under consideration for a long time, and has gradually taken definite form since the independent producers have found an ally in the Union Oil Co. The rumor that the Union is backing the independents is authenticated from a reliable source and is also shown by an examination of the personnel of the officers of the new pipe-line company. These are as follows: president, L. P. St. Clair, president Independent Producers' Agency; vice-president, S. W. Morsehead, president Coalinga Independent Producers' Agency; secretary, Giles Kellogg, secretary Union Oil Co. of California; treasurer, H. H. Welch, treasurer of the Independent Producers' Agency. It is impossible to obtain reliable information at present as to who are the financial backers, but it is surmised that they are among the capitalists who have backed the Union, American Petroleum, and other similar companies, and who are believed to be independent of Standard, Associated Oil, and Southern Pacific influence. The capital stock of the new company is $3,500,000. The intention is to build an 8-in. pipe-line with a minimum capacity of 10,000 bbl. per day, from a point in the Antelope valley, 14 miles south of Dudley, 60 miles to Port Harford, San Luis Obispo county, by way of Polonio Pass, Shandon, Santa Margarita, and San Luis Obispo. Branch 8-in. lines will connect the Antelope Valley station with Coalinga, 40 miles to the northwest, and the McKittrick, Midway, and Sunset districts, 36, 55, and 61 miles, respectively, to the southeast. A branch line 40 miles long will connect the Kern River field with McKittrick. Should the one 8-in. line connecting Antelope valley and Port Harford be insufficient to transport the oil from the feeders, another 8-in. line will be put in along the same right-of-way. The completion of this pipe-line system will indeed make the independent producers what their name signifies. It will mean that the bugaboo of over production, which has been stalking about of late owing to the inability of the marketing and transporting companies to properly handle the supply from some of the San Joaquin Valley fields, will be driven off for many years to come, if not forever. With the steadily growing market and limited productive area, the condition of over production ought never to be anything more than a temporary and local menace, if transportation facilities are at all adequate.

Wildcatting in the north end of the East Side field has shown that the productive territory extends no farther than the middle of Sec. 2, T. 19 S., R. 15 E. Graham No. 3 in Sec. 2 and Tavern No. 1 in the S. W. ¼ of Sec. 38, T. 18 S., R. 15 E., and Peerless Consolidated in the S. E. ¼ of Sec. 28, of the same township, have been abandoned after drilling into and through the oil-sands and finding them devoid of commercial quantities of oil. Attention is now centered on the wells in sections 22 and 26, T. 21 S., R. 21 E., on Jacalitos creek. These wells are drilling for the sand in the Jacalitos anticline, which according to the U. S. Geological Survey report, lies at about 3600 ft. below the surface near the axis of the fold in the creek bed. It is rumored that the El Cerrito well, in Sec. 14, T. 23 S., R. 17 E., is about to be abandoned, no indications of petroleum having been struck in the 3300 or more feet of sand and shale through which this well has been drilled. It is reported that Golden Crest No. 1, in the N. W. ¼ of Sec. 12, T. 22 S., R. 15 E., has struck traces of oil in thin sand in dark-colored shale. This well is now down 1940 ft. Should any of the wells now drilling south of Waltham creek be successful, the proved productive territory in the Coalinga district will be quite materially increased.

On May 1 there were over 440 producing wells in the Coalinga field and 125 drilling. The American Petroleum wells recently brought in indicate that the production increases with the depth. To what limits this holds true, it will be interesting to note as development progresses.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Lode-line in a mining claim is theoretically the central line or longitudinal axis. The law, however, has not been construed so as to make it essential that the actual should coincide with the hypothetical lode-line. It contemplates that a locator shall lay out his lines so as to conform generally to the course of the vein, and cover it substantially.

Blau gas is a new form of illuminant introduced into Germany. It is a liquefied gas, which is sold in tanks of 22 lb., costing $2.90. This quantity will supply a 50-candle-power burner 480 hours. The liquid is drawn into cylinders or globes of special lamps, where it becomes re-gasified. It is said to be free from carbon monoxide, and is non-poisonous.

Jigging is always desirable as a means of concentration when the heavy mineral can be broken clean from gangue by relatively coarse crushing. In many cases the percentage of metalliferous mineral saved can be raised by a preliminary jigging before fine-grinding. Comminution of ores, such as is requisite in preparing them for concentration on Wilfleys and slime concentrators, always renders close-saving more difficult.

Tungsten deposits are usually irregular in their content of tungstic acid (WO_3), and are also liable to be rather superficial. The speculative value of a tungsten deposit is therefore exceedingly small. A prudent purchaser will not pay for more than he can calculate to be available in the mine, as shown by the present development. The price of tungstic acid in ore or concentrate exceeding 50% is about $5 per unit at Eastern points of demand.

Cutter Cove, perhaps the best developed copper mine in the Territory of Magallánes (Magellan), is situated on the west coast of Brunswick peninsula, near the north entrance to Gerome channel (canal Jerónima), and close to Otway sea. It is about 120 miles from Punta Arenas, Chile. The veins vary from 4 to 7 metres wide, and shipments of sorted ore have yielded an average of 7% copper, with about 7 oz. silver per ton. The Cutter Cove Copper Mining Co. is installing a smelter, and a concentrator to clean the low-grade ore.

Opinion concerning origin of the gold in the 'banket' of the Transvaal varies among geologists. Some hold that the deposits are veins in the ordinary sense, the tilted conglomerates having merely formed permeable zones through which the mineralizing solutions, induced by the associated volcanic dikes, had circulated; others affirm that they represent ancient placers, an argument which weakens in the face of the crystalline character of much of the gold. A third hypothesis is that of solution of the original gold in the conglomerates, and its deposition by chemical reaction, which finds support in the crystalline character of the metal, and its association with secondary pyrite crystals and concretions. The 'banket' is not of uniform grade; the variations in gold content are often sudden.

Sea-water affects portland cement by dissolving the lime and depositing sulpho-aluminate of lime, which expands and causes disruption. Concrete will withstand sea-water for five or six years, but will break down rapidly from that time forward. Cement for such situations should be mixed with fresh water, and coarse sand, from which the fine has been screened, should be used. The cement should not be 'over-limed' nor should it contain magnesia. The boiling test is of great utility in proving up the quality of cement for use in salt-water.

Tin in Alaska is found in the western part of Seward Peninsula, about 100 miles northwest of Nome. The localities are known as Ear Mountain, Buck Creek, Cape Mountain, and Lost River. Placer tin is found, but important veins also exist. The veins are associated with limestones and quartz porphyry dikes, the latter cutting through granite. The tin was evidently introduced by gaseous emanations, and most of the characteristic mineral associates of tin are present, together with new minerals, which have caused misconceptions to arise in prospecting.

Explosives stored in caves, tunnels, or in mines are subject to deterioration from moisture. The same is likely to occur when storage magazines are made of stone or brick. The Austrian law requires that magazines be made of wood, with a double sheathing, leaving a hollow space between. The material is required to be extremely light, and only small nails may be used. Such a magazine should be isolated from all sources of conflagration. It is also a most important protection to surround a magazine with an earthen wall as high as explosive is stored. This deflects upward the violence of an explosion and effectually protects surrounding structures.

Copper smelting on the converter principle was tried at East Butte, Montana, and failed. This was the Baggaley process. The Knudsen process, in Norway, is said to yield good results, but it is manifestly limited to a narrow range of ores, and the costs in America would undoubtedly equal those of pyritic smelting. The Fink process is not yet a demonstrated success. The merit in the Fink idea lies in turning over the concentrate by the revolution of the barrel-shaped converter, so as to expose the material to the action of the flame; in short, it means smelting with continuous rabbling. Perfection of detail has not yet been attained. The combination of conversion with this initial melting is of problematic value. Unless conversion, once started, can carry the matte up to 'blister copper', ready for the refinery, it has no practical utility. There is a field for such an appliance in the handling of concentrate, but converter-smelting of ores has no reason for existence. If an ore lend itself to simple pyritic smelting, the blast-furnace possesses manifest advantages for inexpensive treatment.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Panama Canal.

The Editor:

Sir—Absence prevented my seeing your issue of April 24 until a few days ago. Hence my reply to its collection of attacks upon myself is belated. A word of explanation to your readers. In your number of December 19 last you spoke much in derogation of several prominent engineers by comparing their ability unfavorably with that of Lewis M. Haupt. Being, as I stated, familiar with Mr. Haupt's engineering, I undertook, in a personal letter, to try to set you straight. I did not intend to attack him publicly. I did intend to criticise him as an engineer before one editor, because I consider his engineering to be a menace to public welfare. He has already induced Congress to waste half a million of dollars at Aransas Pass, Texas, and ruined the port. You presumed to publish my personal letter in your issue of March 27, thus giving Mr. Haupt's friends the right to think I had gone out of my way to make an uncalled-for attack. For this, you, and not I, should apologize to them. I stand for every word of my letter, which I meant just as I wrote it, without, as your correspondent, H. M. Chance, insinuates, using any "cunningly worded innuendoes." F. Lynwood Garrison criticises me for "claiming to belong to the mining engineering profession," and he "gleans" from my reports a very unfavorable view as to my ability. Mr. Chance would like to have the Mining & Metallurgical Society take up my case as practising a profession for which I was not trained. These charges have no bearing upon the competence of Mr. Haupt to improve harbors, but if I let them pass, your readers will think them true. If I reply to them, I will be using your columns for free professional advertising. As you, Mr. Editor, are responsible for the matter, I am constrained to adopt the latter course and reply, even though it involves too much of the 'perpendicular pronoun'.

The curriculum at West Point covers more geology and mineralogy than many mining engineers ever find occasion to use, while mining in one material sense is an important branch of military engineering. It also happens that I have spent a good part of the last seventeen years studying the origin of precious metal deposits and allied subjects, four years of the time under very favorable circumstances, as I spent a large part of that time in the mining camps of California, covering nearly all of them, on a duty that threw me into direct contact with mines and miners, and I made the best possible use of these and all other opportunities. I will not impose upon your space to recite all these, or the extensive study I have made of the literature of the subject. I have also had a working or supervising interest in several mines. And further, in addition to "commending your mining geology," I have even had the "impertinence and audacity" to prepare part of the materials for a book on the subject of the indications, favorable and unfavorable, to persistence in depth of precious metal deposits. This subject is at present covered only on the one hand by elaborate geological descriptions, of most of which no one can yet make practical application, and on the other by scattered observations of so-called 'practical miners'. However, I have not attempted to cover the entire field of engineering, mining or otherwise. Precious metal deposits and hydraulics are not too large for one engineer to cover, and I believe I can be useful in both of these. I have made quite a number of reports on mining properties, in which I have covered the features I believe I understand. Those who have employed me, I have reason to believe, have done so with the thought that I would tell the truth as I saw it and not 'sell them out' in any way. They have all been satisfied with my work. I am not acquainted with Mr. Garrison or Mr. Chance, and cannot, therefore, express an opinion as to whether the same is true of all their clients. Mr. Garrison is far afield in his rather dark suggestions as to why I resigned from the army. The facts are that I was placed in a position where I either had to quit the army or quit the fight against the corrupt gang of grafters now governing Philadelphia. I chose the former, which choice was made possible by the public-spirited generosity of the late Thomas B. Wanamaker. After resigning, I did my duty as best I could. Had the former mayor, John Weaver, had the character and courage to do his, the tale would have been different, and Messrs. Garrison and Chance would not be getting excited at my "impertinent" intrusion into their chosen field.

As to my friend, Mr. Trautwine, I can only murmur, "Et tu Brute," and say that if there is nothing in my letter derogatory to Mr. Haupt, I failed to make my meaning clear. And now that I have explained that my letter was not written for publication, I trust that Mr. Trautwine will fully absolve me from "seeking applause exclusively for my side of the discussion" by asking an editor to inform himself by reading both sides of it.

However, the subject is too extensive to cover here, and, applause or no applause, I will again commend anyone interested to read the discussion and the original paper, which are to be found in the Transactions of the American Society of Civil Engineers, International Congress, St. Louis, 1904, beginning with Paper 14.

For the benefit of your readers I will give a brief resumé of Mr. Haupt's harbor theories and practices. In 1887 he published a paper on 'Ocean Bars', for which he received a medal from the American Philosophical Society. The above-mentioned discussion shows, I think, conclusively, that every point he made in his paper was wrong, except one, and that was unimportant. The fundamental fact on which he based his theory is shown by the charts to be an error. Worse than that, it was a false statement almost impossible to explain away. It was that every harbor entrance from Jekyl island to Cape Florida was flexed to the north, whereas every one of them except one unchangeable one, was flexed the other way. He tried the same year to get his theories and

plans adopted by the Army Engineers, but they correctly and properly rejected them. Since that date he has lost no opportunity, on every possible occasion, in public and in private, to complain of this alleged unfair treatment. His complaints have been unjust, unfair, and in every way calculated to impress an unprejudiced observer with the fact that the mind that produced them was either wicked in trying to incite prejudice against a most honorable body of men, or else incapable of seeing things with a just balance. Eventually, he got a chance with a private company to try his theories at Aransas Pass, Texas, and though in many writings since he has pretended that this work was in accord with his paper and plans rejected in 1887, there is not one single plan or principle common to the two things. This is perhaps unfortunate, because his present plans have ruined the port, and his 1887 plans could have done no worse. Although officers of the Corps of Engineers have repeatedly pointed out that Mr. Haupt's fantastic jetty at Aransas Pass must be connected with the shore, he has always, by pleading with Congress, been able to prevent this, and now, as was to be expected, the currents have recently dug a deep gorge between the jetty and the shore, resulting in the utter ruin of the port for many years to come. During the discussions that have obtained concerning this work, some things have occurred that show to what extremes a man "who stands up so straight that he leans over backward" will go to defend an erroneous theory. The principal function of Mr. Haupt's Aransas jetty was to keep the drifting sands out of the channel by catching them and storing them at its back before they got into the channel.

In one paper he claimed that the jetty had done this to the extent of 400,000 cu. yd. When it was shown that instead of that amount having been stored behind the jetty, the storage place has lost over two million yards, he explained that the 400,000 yards had gone through some little gaps in the jetty and been later scoured out by the currents—a vastly different matter, and a very poor solution of the problem. This claim was about as honest as to claim that a watchman had kept the burglar out of the house by letting him in at the parlor door and some hours later ejecting him from the kitchen window. On this one episode I take direct issue with Mr. Haupt's defenders as to his candor and trustworthiness.

In his recent reply to my letter under discussion, Mr. Haupt denies my statement on two points. One is the Canal Commission episode. I was not there. I told the tale as it was told to me, with the extra pair of eyes and all. Circumstances beyond my control mak make it hardly proper for me to name my authority publicly, just now. Had you treated my letter as personal, I could have named him to you. And I can hardly call successfully on members of the Commission, but Mr. Haupt can. They would not think it improper to defend a fellow member, and if he will get one of them to say my statement is in error in any essential, I will name my authority, for I repeated the story accurately, and my informant is not a man who "skirmishes with the truth." Mr. Haupt also flatly denies my statement as to the organization of his Reaction Jetty Company and subordinate companies. For reply, I quote the following from his own pamphlet on the subject, which he furnished to the Board on Improving the Mouth of the Columbia River: "The Reaction Jetty Company, authorized capital $1,000,000, 200,000 shares, full paid and non-assessable; incorporated by the State of Delaware, 1902; Lewis M. Haupt, C.E., president; Benj. C. Potts, secretary; principal office, Arcade building, Philadelphia; local agent, The Delaware Trust Company, Wilmington, Del. Proposed method of operating: To carry on the work for which proposals have been submitted to the Secretary of War, under the present appropriations, and where the choice of plans has been left to his discretion, local subsidiary companies are being organized, of representative citizens who desire to avail themselves of the immediate results and deeper channels assured by the introduction of this system, and arrangements will be made to employ local plants and sub-contractors for the equipment and conduct of the work, which involves no risk beyond that of constructing ordinary rock breakwaters. As payments will be based on work in place, under the usual provisions of inspection and monthly returns, a large amount of working capital will not be required at any one locality, and as a consideration for the contract, it is proposed not to charge the Government any royalties for the use of the method, provided the work be given to this company at unit prices which are mutually satisfactory, accompanied by the usual guarantees."

If that does not establish the truth of my statement, I do not understand the English language. And if ever a plan was proposed calculated to introduce the horrors of municipal graft like that of Philadelphia into our now honestly and competently conducted river and harbor works, this of Haupt's Reaction Jetty Co. was surely the worst.

CASSIUS E. GILLETTE.

Philadelphia, June 11.

[Right of rejoinder belongs to him who leads the debate. The matter at issue originally concerned the Panama Canal; it has passed now into mere miasm which it would be offensive to longer tolerate. Questions as to the personal attainments of Messrs. Haupt and Gillette may well rest on the fame each has attained. We fancy that all men have made errors; and that good reputations grow and persist because their successes overbalance their failures. The name and fame of Mr. Haupt as an engineer and as an honest man are so well known that he needs no defense; his reputation is international, and no one can damage it. The reputation Mr. Gillette has made as an indefatigable enemy of the grafter is also a matter of national knowledge, and the people owe him gratitude for his distinguished services in that direction. It is deep cause for regret that personal animosity should have developed in connection with this entirely unnecessary discussion. It would be pleasant to think that our superior men were also superior to letting their thunder be drawn by things which are non-essential. Our remarks which called forth this unfortunate tirade were not an exaltation of Mr. Haupt, as the correspondence might seem to

indicate; we merely referred, in passing, to the attitude of Mr. Haupt in subscribing to the report of the Canal Commission that recommended the Panama route, expressing regret, and hinting that he may have done it in deference to the conviction that it was 'either Panama or nothing'. At the moment when our editorial was published, the country was excited over supposed irregularities in relation to the Canal; the spread of adverse sentiment might have brought pressure to bear upon Congress to curtail appropriations. Such a course would have set back the Canal, perhaps for years. The keynote of the editorial, the patriotic theme to which it was written, was contained in our sentence, "Investigation is proper enough, but the digging must continue;" and again, "Let it be understood that an enterprise of this kind must be pushed unremittingly on an adequate scale, or what has already been done is as good as wasted." It was aside from the point, and in nowise helpful to the purpose we had in view, to raise a personal question. It is too late now to debate the choice of routes, and of little utility to probe the reasons that led to selecting Panama. It would have been welcome to have received from Mr. Gillette endorsement of our position on the great matter which inspired our comment at the time. We are not now called upon to pass on Mr. Gillette's geology nor Mr. Haupt's jetty theories; they may both be deplorable; but we do hope that they will both stand by their guns when it comes to defending the progress of the Isthmian ditch, which we need as a great commercial equalizer between the East and the West. If we misinterpreted Mr. Gillette's intention as to publishing his letter, it becomes our duty to apologize, both to him and to Mr. Haupt, for this muck-raking which has resulted. Our warrant lay in the last paragraph of Mr. Gillette's letter of March 11, omitted from the correspondence as published, which said, "Trusting that this letter and its references will not prove too extended to be of any use to you, I am, etc."—EDITOR.]

Rand Milling Practice.

The Editor:

Sir—Your usually well informed writers apparently have short memories on the subject of Rand metallurgical practice. In perusing your journal of May 22, under the title of 'Rand Milling Practice', your readers would gather that, to use your own expression, "the great mines are *coming* to the simple methods of fine grinding, agitation with cyanide solution, and filtering." Will you permit me to point out, that some of the great mines under our supervision at the Rand came to these methods as far back as 1905, in which year we installed, in the face of universal local opposition, "fine grinding (in tube-mills), agitation with cyanide solution, and filtering" at two mines; the plant on the New Goch mine, treating 700, and the Meyer and Charlton, 450 tons per day. We also advocated the disuse of the other 'innovation' to which you refer, namely the amalgamation process, saying in a paper read before the South African Association of Engineers in June 1906: "The writers have from time to time suggested the possibility of doing away with amalgamation in the mill. The removal of the mill-plates would give easier access to the mortar-boxes, and would permit the placing of the mill work in the hands of trained fitters, whose duty it would be merely to see that the stamp-mill, as a machine, did its work of ore reduction effectively. The position of battery manager, with an attendant foreman, would then entirely disappear, and the whole of the gold treatment process would be under one supervision and separate entirely from the mill. * * * The feeling of the writers is certainly in the direction of doing away with the mill-plates entirely, and they would have no hesitation in equipping any mine on the Rand with this old-time method entirely eliminated." The 1600-lb. stamps, of which so much is heard lately, were introduced on the Rand by us in 1904. In that year we installed an experimental battery of 5 stamps of that weight, on the Meyer and Charlton mine, and secured an output of over 9 tons per stamp per day, through a 20-mesh.

In view of the foregoing facts, we read with considerable surprise in your columns that these 'innovations' are now being introduced on the Rand for the first time, and the credit given elsewhere. If we had not been subjected to the unfairest kind of criticism on the conception of these metallurgical features, and had the wildest doubts not been expressed as to the wisdom of our innovation, we could sit quietly and see the result of our work go unnoticed, but having had the persecution, and having had to more or less quietly endure it, we think we are fairly entitled to protest when our one-time detractors come forward with our schemes and claim credit for them as 'innovations'. We would refer you to our exhaustive paper, read before the South African Association of Engineers, in June 1906, for a complete defence and exposition of what was then called the 'Denny' metallurgy, and we assert without any fear of contradiction that all that has been done metallurgically on the Rand, of any consequence, since that time was forestalled by us several years ago, in the methods we were bold enough to adopt in the plants which were the subject of description in that paper.

G. A. DENNY.

Oaxaca, Mexico, June 1.

Fluorspar in 1908.—The total quantity of fluorspar marketed in the United States during the calendar year 1908, as reported to the U. S. Geological Survey, was 38,795 short tons, valued at $225,998, a decrease from the figures for 1907 of 10,691 short tons in quantity and of $61,354 in value. The marked decrease was due largely to the idleness of many of the open-hearth steel plants throughout the country, but in part to inactivity in the glass and enameling industries. Better conditions have prevailed in these industries during 1909, and the amount of orders booked by the fluorspar-producing companies indicates that the trade for 1909 will be more nearly normal. The bulk of the fluorspar was produced from the Illinois-Kentucky district, and the greater part of the spar was of the gravel variety, which is used as a flux in the basic open-hearth steel furnaces.

MINING ON PRINCE OF WALES ISLAND, ALASKA.

Written for the MINING AND SCIENTIFIC PRESS
By W. A. SCOTT.

Prince of Wales island is separated from the mainland by Clarence strait, which extends from Dixon's Entrance on the south to Sumner strait on the north. The island is 160 miles in length and has an average width of 40 miles, with a coast-line that is indented by inlets and sounds from opposite sides that almost meet. For instance, Chomondeley sound, on the east side, and Hetta inlet, on the west side, are separated from each other by a neck of land three miles wide, over which there is a Government portage. Kasaan bay, Port Johnson, Mora sound, and Big Harbor constitute other indentations of interest, because they are open waterways to the mineral deposits of the island. Mining and mine development are in progress in at least twelve different places, and it is estimated that there are 200 men at work on the island in connection with mining. Four mines are regular shippers of ore, and three or four others may become shippers later in the year. The Sulzer and Commercial, on Hetta inlet; the Mt. Andrew, It, and Goodro, on Kasaan bay; the Niblack, on Mora sound, are all copper mines, yielding some gold. The Dunton, on Kasaan bay, and the property of the Princeton Mining Co., at Dolomi, are considered gold mines; while the Noonshine, situated high on the mountain, overlooking Chomondeley sound, has opened bodies of ore containing galena, silver, and copper. In all cases observed the ore is exposed at the surface, and occurs in masses and lenses, rather than in veins and shoots. The better grades of the copper ore constitute chalcopyrite, as a rule, while in the lower-grade ore the copper is in some cases associated with magnetite, which occurs in great bodies. Two of the best developed properties visited have copper-iron ore on the contact of limestone and granite, and this seems characteristic of the island. The surface of the country is covered by spruce, hemlock, and cedar trees, with an undergrowth that includes everything from the fern and skunk cabbage to the mistletoe and devil club. Ketchikan is the principal supply centre, especially for the east side of the island, gasoline launches carrying passengers, mails, and supplies, making regular trips to various places. At Sulzer, on the west side, is the well stocked store of the Alaska Industrial Co., and Copper City and Klawack are also trading places.

The Sulzer mine, belonging to the Alaska Industrial Co., is managed by Chas. A. Sulzer, president of the company. Interested with him in the property is William Sulzer, congressman of New York. The mine is near the head of Hetta inlet, two miles from the beach, and 1500 to 2000 ft. higher than tide-water. At the beach is a wharf over deep water, ore-bunkers having 4000 tons storage capacity, the aerial tramway terminal, and a hydro-electric plant. The pipeline, which brings to bear a 330-ft. head of water on the Pelton wheel in the electric plant, is 3500 ft. long. The upper section consists of 800 ft. of 14-in. pipe, followed by 1900 ft. of 10-in., then 800 ft. of 8-in., all being wire-wound wooden-stave pipe. The electric power thus generated is transmitted to the mine for all power requirements. The tramway is of the Riblet type, is over 9000 ft. long, has 14 wooden towers, 22 half-ton buckets, having a carrying capacity of 12 tons per hour. The line makes an ascent of 1500 ft. from the bunkers to the upper terminal; toward the upper end there is one span of 2500 feet.

Operations began in a small way in 1902, and on a larger scale in 1905; the bunkers and tramway were built in 1906; ore shipments began in 1907, and since then regular semi-monthly shipments have been made. The first year's shipments were to the smelter at Tacoma, but they go now to the plant of the Tyee



Sulzer Mine of Alaska Industrial Co.

Copper Co. at Ladysmith, B. C. With present facilities 100 tons of ore per day can be produced. The expenditures for mining ore and for development are in the ratio of 3 to 4. The mining costs, charged to the tonnage of ore produced in 1908, were $2.34 per ton; tramming and loading, 30c. per ton. The shipments for that year amounted to 20,732 tons; the shipments for 1909 can hardly be less, and may be greater.

The mining operations are on a mineralized zone that strikes northwest. This zone is 1000 ft. wide in places, but much narrower elsewhere. It has a footwall of granite and a hanging wall of limestone. The granite wall is well defined and has a dip of approximately 60°; the limestone wall is not so well defined,

as the ore fades into the lime from the main bodies. The ore occurs in lenses and irregular masses, with garnet, epidote, feldspar, and altered limestone. It contains from 4 to 5% copper and $1.50 to $2 gold per ton, generally in chalcopyrite. Streaks and lumps of molybdenite are observed in the garnet and limestone. It does not now appear to be of commercial value. The orebodies are opened by a series of adits, or levels, most of which cut the ore at the surface. The vertical distance between the highest and lowest of these levels is 500 ft. The several higher levels are connected by chutes with the main working levels, which connect with the tramway. In all there is said to be about 12,000 ft. of workings. Faces of ore and stoped-out chambers show ore-lenses 50 to 60 ft. wide. The ore is hard, and drills used in it dull rapidly; it stands well and requires little timbering. The Temple air-electric drills are in use, but a Sullivan compressor and air-drills have been ordered to supplement them. The compressor will be installed at the mine and will be electrically driven. The mineral zone, in its strike southeast, cuts the summit of the mountain, which rises 2000 ft. higher than the mine workings. Following the contact northwesterly 2000 ft. or more from the base of operations, the belt is seen to contain bodies of magnetite, with some copper. The outcrop of this ore is conspicuous. Eight of the company's claims on this part of the mineral zone have been leased for five years to the Tyee Copper Co.. R. G. Mellin has been sent there with diamond-drills to thoroughly prospect the ground.

The Mt. Andrew mine is situated on the south side of Kasaan peninsula. It belongs to the Mt. Andrew Iron & Copper Co., having headquarters at Seattle. Sam Lichtenstadter is manager, with W. C. Freeborn as superintendent. The property was formerly under lease to the Britannia company, but is now being operated by the owners. Since November, 1906, 42,000 tons of ore have been shipped, and the company is now shipping at the rate of 1500 tons per month. The ore is sulphide, assaying 4½% copper, 42% iron, and $1.25 per ton in gold and silver. There are ore-bins and a wharf on Kasaan bay, and from this place a 3060-ft. Riblet aerial tramway extends up to the mine. There are, also, two air-compressors at the beach, from which a pipe conveys air to the mine. There is a strong outcrop of copper-iron ore on the surface, along a contact of limestone and syenite, the ore being in irregular bodies. A main working level has been driven from the side of the mountain, cutting 100 ft. below the main croppings; and from this level numerous drifts have been driven to open the orebodies within a large area, the level and drifts aggregating 1000 ft. At various places on the drifts raises have been made to the surface, connecting with open pits. The ore is blasted in these pits, or glory-holes, and sent down through chutes to the drifts, thence conveyed in ore-cars to the bins at the tramway terminal. There are 10 of these glory-holes, not all of which are being actively worked at present. Sinking is in progress on the main level, where a compressed-air hoist is being installed. The Mamie and Stevenstown mines are situated a short distance north of the Mt. Andrew, but these have been inactive for some time.

The It Mining Co. has a shipping mine farther west on Kasaan bay. H. C. Strong, C. H. Black, and John C. Barber are the principal interested parties, Mr. Barber being in direct charge. The ore is chalcopyrite in limestone. About 4000 tons have been shipped since last November, assaying 10% copper at the smelter. It is stated, also, that ore with 10% copper carries $4 gold and 1½ oz. silver per ton. Recently a Sullivan air-compressor and air-drills were installed. The ore is conveyed to the bunkers at the beach over a surface tramway. The Mt. Andrew and It are 30 to 35 miles by water from Ketchikan.

The Goodro mine, in the same locality, has a strong vein of bornite ore, and will make some shipments as soon as the surface tramway is finished. S. J. Goodro is in charge; J. E. Chilberg, of Seattle, is said to be interested in the property. The Dunton, at Hollis, on an arm of Kasaan bay, is a gold property which is being developed by M. K. Rodgers and associates, who will soon have a small stamp-mill installed at the property.

Dolomi district has some gold and silver-bearing veins of ore, on a contact between dolomite and gneiss; some veins there are entirely in dolomite. The gangue of these veins is quartz, which contains gray copper, with which the gold and silver is associated. The most development has been done on the Valparaiso by the Princeton M. Co., for which B. A. Eardley is manager. John Heerdt is connected with this and other locations there. It is reported that the Niblack mine, on Mora sound, will be re-opened this season. It belongs to the Wakefield estate.

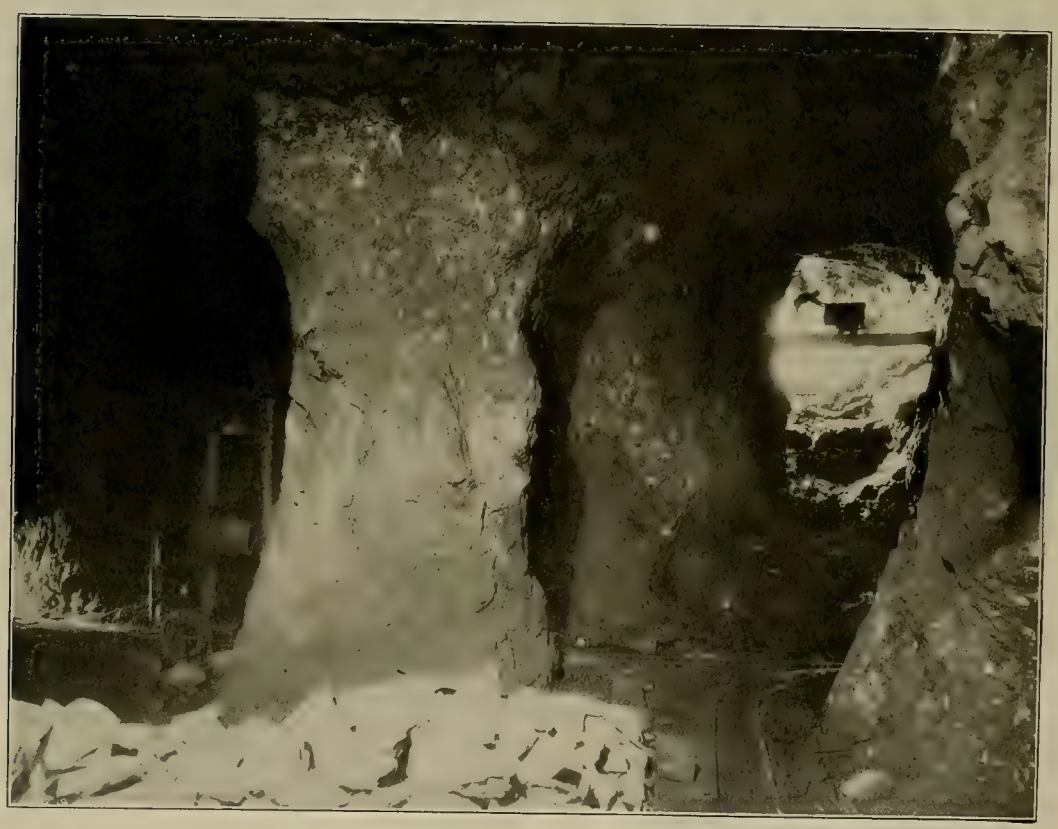
The Gopher-Empire Mining Co., composed of Minnesota and New York people, is represented in this section by E. C. Howard, who is developing some copper and galena claims on Dora inlet, an arm of Chomondeley sound; and who is exploring other parts for the purpose of acquiring properties for this company. Mr. Howard has established an assay office for his own use.

The Northland Development Co. is opening a property on Big Harbor, on the west coast of the island. P. A. Tucker, a stockholder in the company, is in charge of the work. The vein of copper ore lies between limestone and quartzite. The gangue is schistose. There are 250 ft. of development. A test lot of three tons of ore shipped to the smelter showed, on sampling, over 10% copper. A tramway 1800 ft. long may be erected later in the year.

Gold is found at various places along the southern shores of Lake Victoria Nyanza and in the Wembäre Steppe between Tabora and Muanza, German East Africa. Near Sekenke, in the eastern part, a new goldfield has been discovered. The gold exists in quartz veins in granite. The veins are very numerous and contain gold, though not always in great quantities. Operations are already sufficiently advanced for the erection of a plant to work the ore. The total value of the gold exported in 1907 amounted to some £1566, the whole of it going from Muanza by way of the Uganda railway and Mombasa.—*Mining Journal.*



Government Portage Across Prince of Wales Island.



Level and Stope in Sulzer Mine.

FLUORSPAR.

By F. Julius Fohs.

*Centrally located with relation to the largest iron and steel-producing districts of the United States, the fluorspar-deposits of Kentucky possess increasing interest and importance. The value of fluorspar in the manufacture of iron and steel depends upon its ability to form two types of allied slag-products, whereas an acid or a basic flux forms only one. It first forms volatile acid products, in which fluorine is the controlling factor, and then basic slag-forming compounds, in which calcium is the characteristic constituent. Fluorspar is chiefly serviceable, therefore, in the 'basic' processes of steel manufacture, because both the products formed by it are destructive of acid furnace or converter linings. Basic slags, basic furnace linings, and gently oxidizing conditions are necessary if the most favorable results are to be obtained from the use of fluorspar in the making of iron and steel. The thorough purification of iron requires the elimination of silicon, sulphur, and phosphorus, and with these the fluorine of the spar forms fluorides, which are volatile acid compounds, while its calcium forms silicates, sulphides, and phosphides, which are basic slagging compounds. These reactions, and those which occur between limestone and phosphorus, are as follows:

(1) $2CaF_2 + SiO_2 = 2CaO + SiF_4$, and
(2) $2CaO + 2SiO_2 = 2CaSiO_3$; or
(3) $2CaF_2 + 3SiO_2 = 2CaSiO_3 + SiF_4$.
(4) $2CaF_2 + 3S = 2CaS + SF_4$.
(5) $2CaF_2 + 3P = 2CaP + PF_4$.
(6) $3CaCO_3 + 3SiO_2 = 3CaSiO_3 + 3CO_2$.
(7) $3CaCO_3 + 3S = 3CaS + 3CO + 6O$.
(8) $3CaCO_3 + 3P = 3CaP + 3CO + 6O$.

It will be seen from equations (1) and (2) that silica combines with calcium fluoride and sets free two molecules of calcium oxide, which will satisfy two additional molecules of silica, the result being that of equation (3). In the case of sulphur and phosphorus there is a direct interchange of constituents. The reactions attending the joint use of fluorspar and limestone would be expressed by combining equations (3) and (6), (4) and (7), (5) and (8).

The volatilization by fluorine, as shown by these reactions of one-third of the difficultly fusible constituents of slag and the resulting increase in lime content, seem to present the following distinct metallurgical advantages: (1) the slag is more basic, fusible, and liquid; (2) fusion is effected at a lower temperature, which, together with the heat-yield from the formation of fluorides, reduces fuel consumption; and (3) the concentration of the slag increases the metal output.

Fluorspar has a very limited value, if any, in assisting in the removal of carbon or manganese. An excess of this flux over the quantity required to flux the silica, sulphur, and phosphorus, would alloy graphite and manganese with the iron and reduce silica to silicon; and fluorides would be formed which, in the reaction with the hydrogen of the furnace gases, would be reduced to metals and hydrofluoric acid. Such an employment of fluorspar requires very careful manipulation; but it may be made to give, as desired, either pure iron, iron of slightly altered qualities, or a distinct alloy.

In quantitative effect, fluorspar has a distinct advantage over other basic fluxes—about two to one as compared with calcium carbonate, the cheapest of them. Moreover, by reason of the volatilization of one-third of the impurities, it forms only two-thirds as much slag as limestone. But it costs eight or ten times as much as limestone; and large quantities of it would produce effects opposite to those desired. Hence the best present practice is to use as a flux in iron and steel metallurgy a comparatively large proportion of limestone and a small proportion of fluorspar (in order to secure the peculiar effects of the latter). This practice is not very expensive. For example, if limestone costs $0.50 and flourspar $5 per ton, the use of 3% of fluorspar in the flux would make the cost per ton of flux 63.5c., instead of 50c., or only 9% of increase in the cost of the flux for each 1% of fluorspar. The substitution of other basic fluxes for part of the limestone will not interfere with the action of the fluorspar; but some of them, like dolomite, require a greater percentage of fluorspar to lower their melting point.

The net fluxing value of a crude fluorspar may be determined with sufficient accuracy by deducting the silica plus 2 units of basic impurities or 1 unit of calcium fluoride for each unit of silica. Thus, in a material containing 91% of calcium fluoride, 2 of silica and 7 of calcium carbonate, alumina, iron oxides, etc., the 2 units of silica could be regarded as practically neutralized by 4 units of the basic fluxes, leaving as the net flux 91 of calcium fluoride and 3 of basic compounds; whereas, if the material contained 91 calcium fluoride and 9 silica, it would be necessary to deduct 9 units of the fluoride to satisfy the silica, leaving as net flux 82% of calcium fluoride.

Fuorspar is commercially obtainable in four grades. Stated in percentage, the first carries from 96 to 98 calcium fluoride, with not more than 2 silica; the second, 90 fluoride, with less than 4 silica; the third, 80 fluoride, with a maximum of 12 silica; and the fourth, about 60 fluoride, with a maximum of 15 silica. Concerning these grades, it may be added that the first, by reason of its cost, is little used in iron and steel works; the second is the most available for that purpose, though in some cases it might be economical to require, and pay for, a material considerably lower in silica than 4%. The third is likely to give, after due allowance for the basic constituents, about 78%, and the fourth a minimum of 60 fluoride with 10% of available basic flux. The economic limit for the purchaser is about 8% of silica; and the third and fourth grades should be purchased only on the basis of their net fluxing value, as determined by the method suggested above.

The proportion of fluorspar which can be used with advantage is thus seen to be a variable, dependent upon the price of the crude material, the process in which it is employed, and the impurities of flux, fuel, and ore. The calculations of the furnace man-

*Abstracted from Trans. Amer. Inst. Min. Eng.

ager should be made accordingly. It may be said, however, that where pure limestone is the main flux, from 1.5 to 8, on the average 3, of fluorspar to 100 of limestone is sufficient to secure the main advantages of the compound flux; for magnesian limestone, from 15 to 30% of the fluoride may be required. The fluorspar-limestone flux may be useful in the manufacture of pig-iron, wrought-iron, crucible-steel, basic bessemer and open-hearth steel, iron and steel alloys, and ordinary and malleable iron castings. In rare instances, and in small quantities, it may be serviceable in the acid steel processes also. In blast-furnace practice it has been, as yet, but little used, for the reason that its advantages are not generally understood, and its cost has been regarded as prohibitory. As has been shown above, however, the additional expense of using a certain percentage of fluorspar is not great in comparison with the economic and technical benefit thus secured; and its use may therefore reasonably be expected to increase. It is specially advantageous in the smelting of highly silicious ores, and for the purpose of 'thinning' a too limy slag—for which it is used by the Illinois Steel Co. It may be blown as a powder through the tuyeres, or intimately mixed with the charge. It should be of service in smelting iron ores in the electric furnace, since it lowers the temperature of fusion. It is known to be serviceable for this purpose in other electric-furnace operations, as in the Lungwitz zinc process, in making alundum, carbolite, and so forth.

In the bessemer process, because of the strongly oxidizing conditions, fluorspar is little used. But even here, it appears, according to Howe, to assist by melting the lime rapidly, in making an effectively basic slag, with which phosphorus combines readily during the early part of the operation. It is in the basic open-hearth process that American fluorspar is mostly used, especially in plants which produce steel for rails, tubing, or castings, for which the highest quality of open-hearth steel is required. In this process, fluorspar is used to facilitate the liquefaction or thinning of the slag (especially to help melt the flux or limestone), thus reducing by about half the time required for the melt. It is only to be used when the limestone is soft and white-hot, floating at the top of the bath, usually about two hours prior to the completion of the heat. If used sooner, it makes the slag too thin. If too much limestone is charged, fluorspar is helpful in converting it to slag quickly. An excess of fluorspar thins the slag too much, with harmful results, such as the rapid oxidation of the carbon, which reduces the temperature; the excessive oxidation of iron, which causes losses of metal, and also thins the slag; and the too-rapid oxidation of other impurities (such as phosphorus and sulphur), which gives them opportunity to become again reduced and alloyed with the metal. The per cent of fluorspar to that of limestone in this process varies from zero to 8, with 3% as an average. Where the slag is sufficiently thin, or if sufficient scale, iron oxide, has been used, no fluorspar at all may be required. If the slag is thick and melts slowly, a little fluorspar is shoveled in. An intelligent furnace-man requires less fluorspar than a careless one. The requirement of fluorspar per furnace is about 100 tons per year. 'Gravel' fluorspar is used, usually of the second grade.

The procedure in open-hearth practice, according to a private communication from J. W. L. Kerr, is as follows: Magnesite and dolomite are first put in as furnace-lining. Afterward 6.5 tons of limestone and 25 to 35 tons of scrap-iron are put in and heated together. At the right heat, the melted pig-iron necessary to make the total charge 60 to 70 tons is added. Lake Superior hematite is then added until the carbon is reduced from 0.18 to 0.08%. Pieces of limestone come to the surface in blocks; and fluorspar is used in amounts varying from 200 to 1100 lb., or about 0.15 to 0.8%, per charge, both to break up the limestone blocks and to reduce sulphur and phosphorus. At the Illinois Steel Co.'s South Chicago Works the practice, according to a private communication from George L. Danforth, Jr., is to use from 0 to 15 lb. of fluorspar, 6 lb. on the average, to 200 lb. of limestone per ton of basic open-hearth steel produced, the iron charged being half pig, half scrap. No actual weights are taken, and the gravel fluorspar is shoveled in as needed when the limestone is at the right heat. Where 50 tons of cheap scrap-iron are used, the use of 2.5% of fluorspar is said to give as fine steel as the best pig produces. Carr proposes the addition of 13 lb. of fluorspar with 300 lb. of limestone to 1227 lb. of pig-iron and steel scrap for each ton of basic open-hearth cast-steel produced.

Flourspar is a valuable flux in the preparation of iron and steel alloys, and here its value depends on its use in excess in conjunction with a highly basic flux in reducing carbon, manganese, silicon, chromium, nickel, etc., as previously explained. In the ordinary blast-furnace, ferro-silicon, containing as much as 10% of silicon, can be produced from any silicious ore in this manner. Likewise, spiegeleisen, low or high ferro-manganese, or metallic manganese, may be produced. In the last case, the flux consists of alumina, lime, and fluorspar.

The objections that have arisen in some quarters to the use of fluorspar in foundry practice are due to the ignorance of its capabilities and manner of use. The dealers who sell fluorspar as a flux under high-sounding names, making extravagant claims as to its effect in extremely small quantity, and charging correspondingly high prices for it, are chiefly to blame for this. That its use alone has proved unsatisfactory is not surprising. When it has been used in conjunction with limestone, the failures have been due to an insufficient amount of total flux, usually with the additional error of an improper proportion of fluorspar and limestone in the mixture. This explains the unsatisfactory results of the Foundryman's Laboratory tests, reported by N. W. Shed, in which it was sought to reduce sulphur and phosphorus without making allowance for either the fluorspar or the limestone which would necessarily flux part of the silica of both the coke and the pig-iron—a neutralization which left no fluorspar available to reduce the sulphur or the phosphorus.

The present foundry-practice is to use pure limestone for flux in the cupola, 100 lb. of limestone to a

2-ton charge, and either no fluorspar at all or only such small quantities of it as are necessary to help bring about a quick melt of the limestone. If no pure limestone is available, then dolomite is used, and in conjunction with this fluorspar is indispensable. In many foundries, especially in the small ones, only a single 2-hour heat is made per day, so that the time consumed is immaterial. In the large foundries continuous heats are demanded, with an output of at least 15 tons per hour. The use of fluorspar reduces the length of time required for each melt. Where fluorspar is used with dolomite, only one-half as much time is required as for dolomite without fluorspar. The type of cupola used makes little difference.

A typical practice in this respect is that of the Crane Co., Chicago, which, after repeated attempts to get pure limestone for flux, settled upon the use of dolomite and fluorspar in the ratio of 25 or 30% of flourspar to 100% of dolomite. Analyses of typical fluxes used are as follows:

	SiO_2	P	Fe_2O_3+ Al_2O_3	CaF_2	$CaCO_3$	$MgCO_3$	PbS	ZnS $ZnCO_3$
Fluorspar,	1.37	0.006	0.50	96.75	....	....	0.08	1.69
Dolomite,	1.08	0.007	0.68	....	53.50	45.19	...	...

Such fluorspar has 90% of available calcium fluoride, for some flourspar is necessary to flux the lead and zinc as well as the silica. A flourspar is specified for this use that contains less than 2% of silica, and the dolomite must not contain a greater amount. This means that only No. 1 fluorspar can be used. Lump is purchased, as it is likely to contain less silica. After the fluorspar reaches the foundry it is broken into pieces not larger than the size of an egg, since larger pieces would be likely to strike the lining and, combining with it, destroy it. The cupolas have the usual fire-brick linings, which, if the precaution is observed, are but slightly if at all affected. The sulphur is not likely to be reduced materially by the use of flourspar if there be less than 1%, but if there be more the reduction of sulphur will be marked.

Aside from its use in the cupola, a small percentage of ground fluorspar, placed at the bottom of the ladle, serves to slag impurities, which rise to the surface as a heavy mass, and, after stirring to insure perfect mixture, are skimmed off. According to R. C. Hills, gray iron so treated produced not only a softer iron, but when molded into bars and broken on a testing machine, showed 11% greater breaking-strain than bars made from the same pig not so treated. For malleable iron, similar treatment showed a more malleable iron with an increased tensile strength and an increase in elongation over ordinary malleable iron. Frogs made of this material cracked to a far smaller extent than ordinarily.

The use of flourspar in the iron and steel industry is extending. At present, the percentage of flourspar consumed is one-half of 1% of the quantity of limestone flux used in America; but there has been a small but steady increase in its use during recent years. This is chiefly due to the extension of the basic open-hearth steel manufacture. Fully 80% of the American fluorspar is consumed in basic open-hearth plants. Of this quantity, more than 90% is in the 'gravel' form.

ELECTROLYTIC REFINING OF GOLD.

B T. K. Rose.

*The separation of silver and other impurities from gold by electrolysis in a solution of hydrochloric acid was suggested by Charles Watt of Sydney in 1863. He proposed to apply the method at the Sydney Mint, and claimed to have discovered means of preventing the evolution of chlorine from the anode, but no steps were taken to test his process. In 1878, Wohlwill of Hamburg introduced his process at the Norddeutsche Affinerie, and it has since been applied elsewhere in Germany. It displaced the sulphuric acid process at the Philadelphia Mint in 1902, and at the Denver and San Francisco Mints in subsequent years, and is in process of being installed at the Ottawa Mint. It has made little progress in other countries.

In the Wohlwill process the electrolyte is a solution of gold chloride containing from 25 to 60 grams of gold per litre, and from 20 to 100 c.c. of concentrated HCl per litre. It is heated to a temperature of about 60 to 70°. The anodes consist of impure gold, containing not more than 60 or 70 parts of silver per 1000, and the cathodes of pure sheet gold. The anodes dissolve partly as trivalent gold, forming $HAuCl_4$, and partly as monovalent gold. The AuCl formed at the anode is partly decomposed into $AuCl_3$, and metallic gold, which falls to the bottom, but some of the monovalent gold ions reach the cathodes. The higher the current density the more trivalent gold is dissolved and the less AuCl is formed, so that there is less gold in the slime at the bottom. The current employed in the United States is from 300 to 600 amperes per square metre of anode-surface. The deposition of gold at the cathodes is greater than the amount dissolved at the anodes, owing to the presence of impurities in the unrefined gold, so that it is necessary to add chloride of gold to the solution at intervals. Silver is converted into AgCl at the anodes, and falls to the bottom of the vessel, or is in part dissolved. The anodes may contain up to 150 per 1000 of silver, but if such a large proportion is present it is necessary to scrape the silver chloride from the surface of the plates. Platinum is dissolved with the gold and accumulates in the solution, from which it is recovered in the ordinary way. The deposited gold is nearly pure.

The electrolyte is circulated by mechanical means, and is renewed when it has been made foul by the accumulation in it of copper, palladium, etc. Lead makes the deposited gold impure, but may be rendered insoluble by the addition of sulphuric acid.

Apart from observations on the technical details of this process, the points on which information is particularly required are: (1) the time required to complete the process. This is most important, because of the loss of interest on the gold under treatment. The chief objection to the application of this process in England is the fear that the process is too slow. (2) The cost for labor, power, etc. (3) Whether, if speed is unduly increased, the gold is likely to be of bad quality, contaminated with lead or other elements which would make it brittle.

*Read at the International Congress of Applied Chemistry.

HISTORICAL GEOLOGY OF CALIFORNIA.

Written for the MINING AND SCIENTIFIC PRESS
By WILLIAM FORSTNER.

(Continued From Page 858, June 19.)

Tertiary (Cenozoic).

Sierra Region. During the Eocene the Cretaceous erosion period of the Sierras continued, and the Eocene is not represented in the Sierras north of the Merced river. In the extreme southern portion, near the Tehachapi range, however, the Eocene Tejón becomes prominent. At or near the close of the Eocene an orographic disturbance took place in the Sierra region. At that period the Sierra Nevada was a range of low relief, and erosion took place with moderate intensity.[44] A zone of normal faulting was inaugurated along the eastern slope of the Sierra,



Cemented Gravels Covered by Bowlder Clay. Minersville.

due to the deformation of the Great Basin, as a thick series of Miocene beds but no Eocene beds were laid down in the low trough formed east of the Sierra. It is highly probable that this fault was inaugurated either within or at the close of the Eocene.[45]

The Auriferous Gravels. The Lower Miocene stream-beds had a shallow trough-like form. In their centre is frequently found a deeper cut, indicating a short period of active erosion just before the beginning of the Gravel period. At this time, probably the beginning of the Miocene, the streams became charged with more detritus than they could carry; the character of the gravel accumulations point clearly to a somewhat rapid stream, and that they are due more to rapid overloading than to a low grade in the rivers.[46] These conditions can be best explained by a relative elevation of the high Sierra, leaving the lower slopes unchanged, and this disturbance may be synchronous with the disturbance along the east slope of the Sierra Nevada. During the Miocene this accumulation of gravel in the river-beds and on adjacent benches continued up to a present elevation of from 5000 to 6000 ft., while above that elevation erosion still continued. These formed the gravels of the first period. Their age was formerly supposed to be Pliocene, but later investigation has proved it to be Miocene; they are chiefly composed of white quartz pebbles and light colored clays and sands, with minor lava flows of rhyolite, and are free from volcanic pebbles. They are often called the 'white-quartz gravels'. Their lower portion is a



Manzanita Gravel Mine, Nevada City



Drift Mine, Lewiston.

conglomerate of pebbles and boulders, often of large size, usually of a blue-slate color, from which it derives the name of 'blue gravel'.

The first Miocene eruptions consisted of flows of rhyolite, which poured down the valleys, becoming mixed with the detrital material on the way. Lower down they are found as semi-volcanic sands, clays, and gravels, forming fine-grained beds of a brilliant white color, locally called 'pipe clay'. These rhyolite flows usually confined themselves to the valleys and formed a capping over the gravel from 50 to 150 ft. thick. In places this tuffaceous material is overlaid by a basalt flow, forming table-lands; these older basalts are, however, not represented in the section between the Yuba and the American rivers. After the rhyolite and older basalt flows came a period of erosion, with some minor intermediate volcanic outbursts, during which the rivers had to seek new channels, confined generally to the older valleys. During

[44] Folio 43, U. S. G. S.

[45] 17th Ann. Rep., U. S. G. S., Pt. I, p. 530; 40th Parallel Survey, Syst. Geol., Vol. I, p. 744; and Am. Jour. of Sci., Vol. 38, p. 262.

[46] Bull. Geol. Soc. of Am., Vol. IV, p. 265.

this period were formed the channels of the intermediate period. The pebbles of these channels are chiefly of pre-Cretaceous rocks. These gravels are usually dark in color, are less auriferous than the 'white quartz gravels', and are locally known as 'bull' or 'bastard gravels'. After this period of relative quiescence of the volcanoes in the high Sierra resumed activity, and a period of intermittent andesitic flows succeeded. Again the rivers were displaced, and whenever the intervals between the eruptions permitted, they resumed the cutting of their channels through the accumulated silt. The gravels of the volcanic period form the gravels of the second period, namely, that of the 'volcanic cement gravels', and they contain abundant volcanic pebbles. The plant-remains in these gravels are not abundant; they are probably Upper Miocene or Lower Pliocene. All these channels were finally buried by the last great andesitic flows, which covered the lower and middle slopes of the Sierra Nevada to such an extent that only isolated peaks and ridges protruded. These came down as successive mud-flows, settling soon into a hard, compact, gray or brown rock, a tuffaceous breccia, containing large, usually angular boulders of andesite. This eruption is assumed to close the Pliocene, and forms the horizon by which the Neocene and Pleistocene accumulations are separated. The Neocene shore-gravels are of the same age as the later auriferous river-gravels, but were deposited in the waters of the gulf which covered the Great Valley of California.[47] In the latter part of the Pliocene the dislocation at the eastern base of the Sierra Nevada was greatly accentuated. The northern portion of the Sierra Nevada consists of three orographic blocks, while in the central and southern portions the range appears to be formed of one great orographic block, which is continuous with the western block of the northern end.[48] Along the western foothills, and at the base of the Sierra Nevada, the Miocene is represented by the Ione formation, consisting of beds of clay and sand, with layers of lignite. The clay is locally used for the manufacture of pottery.[49] In great extent it is covered by later sediments. In the northern part of the western foothills, the Ione is overlaid by the Pliocene Tuscan tuffs, consisting chiefly of basaltic tuffs, with fragments of andesitic lavas and older rocks.[50]

Northern California. At the close of, or perhaps a little later than, the middle of the Chico, northern California and southern Oregon were raised above sea-level and were subjected to erosion, and as far as known no Eocene deposits occur in northern California except one fresh-water deposit in Hay Fork valley, Trinity county.[51] On the northwest border of the Sacramento valley is a well marked base-level plain of erosion, which runs from Elder creek to near the Great Bend of the Pit river, a distance of about 100 miles. It passes to the east beneath the lavas of Lassen peak, suggesting that it may reach the plateau of the interior region, now covered by volcanic material. Within northeastern California and the adjacent part of Oregon are vast stretches of level places which are not far from the same altitude above the sea. As far as known, all the surrounding hills in that region are of lava. The largest part of this plain has been carved on the up-turned edges of the Cretaceous. The erosion necessary for its development out of the topography resulting from the uplift at the close of the Cretaceous must have occupied a long interval of time, possibly beginning in the late Cretaceous and continuing through the Eocene and the earlier Miocene.[52]

The Miocene is represented by the Ione formation, which, being well stratified, must have been laid down in an extensive body of water. Due to the above-mentioned post-Cretaceous uplift, the ocean was excluded from the region of the present Sacramento valley north of Marysville, and from the Lassen strait, and this region, as well as a large area in eastern Oregon, was covered by a large body of fresh water, which has been called Piute lake. The Ione formation consists of gravel, sand, and clay, partly but feebly indurated into conglomerates, sandstones, and shales, with some seams of lignite. The unconformity of the Ione with the underlying Cretaceous on the west side of the Sacramento valley is much more marked than in the Lassen Strait region, showing that the post-Cretaceous disturbance was much stronger in the Klamath district than to the east of it.[53] Within the Klamath mountains are five isolated brackish or fresh-water Miocene deposits, of which that of Hay Fork is the chief.[54] There is reason to believe that the earlier eruptions in the Lassen Peak region occurred in the Pliocene, and may be contemporaneous with the late andesitic eruptions in the Sierra Nevada. Their tuffs (the Tuscan) were unquestionably deposited about the same time near the shore of Piute lake. These Pliocene eruptions must have been accompanied by a disturbance of the entire region, for the Tuscan tuffs rest unconformably upon the eroded surface of the Ione. Subsequent to their deposition a differential uplift, being greatest eastward, raised the tuffs above the level of the lacustrine waters, and formed a monoclinal fold at the western limit of the region, running from Battle creek to Deer creek. Toward the close of the Miocene began a series of differential uplifts and intervening periods of quiesence and erosion. This lasted during the later Miocene and Pliocene and persisted during the Pleisticene.[56]

(To be Continued.)

[47] Sierra Folios, U. S. G. S.; Am. Geol., Vol. XV, pp. 371-375; Bull. Geol. Soc. of Am., Vol. IV, pp. 263-267; Am. Jour. of Sci., 3rd series, Vol. XIX, pp. 176-189; 10th Rep. Cal. Sta. Min. B., pp. 435-455; and 14th Ann. Rep., U. S. G. S., Pt. II, p. 468.

[48] 8th Ann. Rep., U. S. G. S., Pt. I, pp. 426-428; and Bull. Dpt. of Geol., Univ. of Cal., Vol. III, No. 12, pp. 362-364.

[49] Folios 5, 11, 18, and 41, U. S. G. S.; and 14th Ann. Rep., U. S. G. S., Pt. II, p. 464.

[50] 17th Ann. Rep., U. S. G. S., Pt. I, p. 540.

[51] 14th Ann. Rep., U. S. G. S., Pt. II, p. 424; and Am. Jour. of Sci., Vol. 165, p. 356.

[52] 14th Ann. Rep., U. S. G. S., Pt. II, pp. 406-414.

[53] 8th Ann. Rep., U. S. G. S., Pt. I, p. 431; 14th Ann. Rep., U. S. G. S., p. 422; and Folios 15 and 138, U. S. G. S.

[54] Am. Jour. of Sci., Vol. 165, pp. 356 and 357; and Bull. No. 196, U. S. G. S., pp. 41-45.

[56] 8th Ann. Rep., U. S. G. S., Pt. I, p. 428; Bull. No. 196, U. S. G. S., pp. 10-13.

COSTS AT THE OSCEOLA MINE.

Written for the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN.

The cost per ton of ore hoisted by the Osceola Consolidated Mining Co., in Michigan, for the years 1905, 1906, and 1907 were as follows:

Items of Expense.	1905.	1906.	1907.
Mining	$1.055	$1.123	$1.282
Rock-house	0.067	0.071	0.068
Transportation	0.079	0.080	0.084
Stamping	0.155	0.128	0.109
Surface	0.008	0.012	0.027
Office	0.012	0.010	0.015
Incidental	0.105	0.111	0.241
Total without construction	$1.482	$1.535	$1.826
Construction	0.117	0.119	0.098
Total, including construction	$1.599	$1.654	$1.924
Waste sorted out	8.3%	7.2%	5.2%

Of the above items, that for mining only is given in detail, as shown below:

	1905		1906	
Underground contracts.		$0.540		$0.560
Tramming		0.186		0.205
Timbering:				
Labor	$0.026		$0.025	
Supplies	0.020		0.017	
		0.046		0.042
Compressor:				
Labor	0.033		0.030	
Power supplies	0.030		0.027	
Miscellaneous	0.020		0.016	
		0.083		0.073
Miscellaneous:				
Labor	0.110		0.132	
Power supplies	0.072		0.060	
Miscellaneous supplies	0.034		0.050	
		0.217		0.242
Total mining expense..		$1.055		$1.122

For the first eleven months of 1907 mining expense is differently divided, as follows:

Underground contracts:		
Labor	$0.459	
Power	0.084	
Miscellaneous	0.113	
		$0.656
Tramming		0.316
Hoisting:		
Labor	0.040	
Power, etc.	0.076	
Miscellaneous	0.028	
		0.144
Miscellaneous:		
Labor	0.103	
Power supplies	0.028	
Miscellaneous supplies	0.036	
		0.167
		$1.283

The table below gives the number of tons stamped, and the product of the Osceola mine in 1905, 1906, and the first eleven months of 1907:

	1905.	1906.	1907.
Ore stamped, tons	1,007,200	1,016,240	767,665
Concentrate produced, lb.	24,458,000	23,910,000	17,398,700
Barrel copper produced, lb.	396,391	326,281	2,037,756
Total product, lb	24,854,391	24,236,281	17,602,458
Total ingot copper, lb.	18,938,965	18,588,451	13,358,262

LOW PRESSURE STEAM TURBINES.

By I. N. HOLLIS.

*While the steam turbine is admirably adapted to a low vacuum, the steam engine can not make economical use of low pressures, on acount of the enormous size of cylinder required. The volume of one pound of steam at 175-lb. pressure is 2.608 cu. ft., and that at ½-lb. pressure is 648.6 cu. ft. For example, a compound engine with cylinders 36 by 72 by 48 in. would require a third cylinder of at least 200 in. diam. to make use of steam expanded down to ½-lb. pressure. Even if it were possible to build and operate cylinders of such dimensions, the loss by condensation, radiation, and friction would more than offset the gain from the use of greater ranges of expansion. Hence compound and triple-expansion engines can never take full advantage of the lower vacuums. On the other hand, the high-pressure part of a turbine cannot make as effective use of steam as the low-pressure part, for two reasons: In the first place, the percentage of leakage by the blades is much greater; and in the second place, the rotation-losses due to the higher density of the steam are large. The steam engine and the turbine are then natural companions, one for high and the other for low pressures, although it is still extremely doubtful if the two should be designed and built for combined operation in a new station.

The percentage of available energy actually realized in practice varies within wide limits, depending upon the conditions and upon the size of the engine. A good performance for the ordinary compound engine is about 70% efficiency in the cylinders, and the return of energy for one pound of dry saturated steam is then $0.70 \times 204{,}300 = 143{,}010$ foot-pounds, equivalent to 13.84 lb. of feed water per indicated horse-power per hour, or to 20.28 lb. per kilowatt-hour, at the switchboard. If the efficiency of a noncondensing compound engine be taken at 66 at the switchboard, the energy actually realized will be 91,368 foot-pounds, and the steam consumed about 29.05 lb. per kilowatt-hour. This is a better rate than is commonly realized in non-condensing engines, but the range of pressure is higher.

In case the steam were taken into a low-pressure turbine after having done its work in the steam engine, the energy actually realized in addition to that already yielded at the switchboard, would be about $0.68 \times 138{,}000 = 93{,}840$ foot-pounds, thus requiring for the turbine alone 28.28 lb. steam per kilowatt-hour. If the return of energy from the turbine be added to that from the engine, the feed-water per kilowatt-hour would be 14.33 lb. The vacuum has been taken rather better than is to be found in the average turbine station; on the other hand, the efficiencies assumed are below the best that can be realized with engines and turbines of large power.

Hardness in steel and iron varies with the composition. On the scleroscope scale bessemer rail shows hardness of about 30, manganese steel shows hardness of 40 to 50, chilled cast-iron, 65 to 75.

*Abstract from article in *Engineering Magazine*.

PHOTOGRAPHY IN MINING.

Written for the MINING AND SCIENTIFIC PRESS
By J. B. LANFIELD.

The large use made of photographs in all reports, and the many types of apparatus available, perhaps warrant the following suggestions. The camera has become a useful, not to say necessary, instrument in the mining engineer's equipment, and as such, care should be taken in its selection and skill employed in its use.

There are two important questions to be decided in the selection of a camera, the question of size and the question of plate versus film. The latter is not easy to settle, for there are strong arguments on each side. The film has the great advantage in portability. It is light and does not break, and fresh rolls can be inserted in the camera very quickly. On the other hand, plates keep much better (in tropical countries films are almost useless), and can be had in faster speeds, and in general the results obtained are more satisfactory. In fact the proportion of fine negatives is so much greater that a dozen plates are usually equal to two or three times that number of films. Plates may be easily put into plate-holders in daylight by means of a changing bag, and can likewise be developed in a tank without a dark-room. If packed snugly in the boxes in which they come there is little danger of breakage. For my own part I much prefer to take plates with me, but if anyone prefers to use a film camera in the field, I strongly recommend him to precede this by practice with a plate camera. Mining photography, especially on the geological side, demands definition and tone values that can only be obtained by skill in focusing and exposure, and, contrary to general belief, the kodak seldom achieves fine results except in the hands of the expert trained in stand photography. As to the question of size, the best English practice has given up the use of large cameras. It is much better to take a small, sharp negative and enlarge from it. The fact is that the engineer really needs two cameras, one a small pocket camera, always ready to catch the chance view without the delay incident to taking out of case and focusing, and a regular stand-camera complete, capable of being used for any kind of photography. For the first a No. 1A folding pocket kodak, or something similar, answers the purpose. For my own part, I use a Newman & Guardia 'Sybil' camera, 2½ by 3½ in., with a Zeiss Tessar lens, the most compact camera made.

The stand-camera should be a substantial box, simple and strongly built. In general the German boxes are too complicated with ingenious devices which, unfortunately, get out of order easily. The boxes made in America are seldom strong and durable. A teak-wood box, brass bound, is best of all, as it is not affected by changes of climate. It should have a bellows of good length that can be extended for tele-photo work. Do not economize in the matter of a lens; buy a first-class anastigmat of fairly short focus—short enough for underground pictures—and preferably one which can be changed to long focus by removing the front section. This obviates the necessity in most cases of a separate tele-photo lens. A fine all-round lens is the Goerz Dagor double anastigmat, Series III, working at F. 6.8. The stand-camera should not be large—not larger than 4 by 5, and better 3¼ by 4¼, or what is termed in England 'quarter-plate'. It is absurd to carry around a 5 by 7 or 6½ by 8½ camera with its complement of plates, when the smaller size negatives enlarge to 8 by 10 inches and make just as good a picture if not better. Do not fail to equip your camera with a color screen (or ray filter) to secure the proper tone values for colors in nature. One need not call attention to the necessity of this for photographing rocks that vary in color and that would without this precaution appear identical in the picture. Do not forget that with the color screen you must double or treble the exposure, according to the density of the screen. It is well also to equip your camera with the color screen required for using the Lumière autochrome plates for color photography. The outfit should also include an exposure meter—Wynne's or Watkins'—to determine the length of exposure and thereby save many a plate that would otherwise be wasted, plate-holders for a dozen plates, a focusing cloth in the form of a sleeve gathered with an elastic tape at one end to fit over the camera back, and having a piece of leather at the other end with two eye-holes cut in it, and elastic tapes to loop over the ears, and a firm wooden tripod. I have long since given up the tremulous, easily-broken, aluminum ones.

Out of a veritable museum of cameras which I have indulged in I have settled down upon an English box, the Sinclair 'Una' camera, 3¼ by 4¼ in., as altogether the most satisfactory. With it is a strong leather case in which I carry it strapped to the horn of my saddle when I am in the field. A nickel-plated developing tank, which measures 2 by 4 by 6 in. and takes both 2½ by 3½ and 3¼ by 4¼ plates; two or three packages of '3½-A' kodak developing powders, a pound or two of acid hypo fixing powder and some flash-light powder, and my equipment is complete. It takes up very little room, and even with six dozen plates of each size is not heavy. With this equipment I can get exactly the picture I need. If it is necessary to photograph a mill or a dump on a steep hill-side I can cross the valley, and by using the tele-photo lens and extending the bellows, draw the object near, when ordinarily it would show but a speck on the plate. Again, I can use the same tele-photo lens to take a picture of a small crystal or specimen, magnifying it so as to cover the whole plate. Underground photography is not easy, as it is frequently very difficult to find a position from which a desired face can be taken. In using flashlight for this work, do not burn it all in one place; divide the required quantity in two and set it off on either side of the camera; this will give you a picture of the face without deep shadows.

In conclusion, take every care not to let the slightest ray of light reach your films or plates in changing or developing; focus carefully and expose accurately; the result will be that you will have a good negative to show for practically every exposure, instead of the small percentage obtained under the old 'you push the button and we do the rest' system.

MONTREAL RIVER DISTRICT.

By W. H. Collins.

*A widely circulated and seemingly reasonable opinion holds the diabase responsible for the valuable silver-cobalt deposits of the region. The testimony of the Montreal River district as yet known supports this belief.

Early in August a discovery of native silver was made just west of Gowganda lake, and recorded at Elk Lake early in September. Up to that time only a small number of prospectors had been at work in this locality, but immediately following the news of the discovery came an influx of several hundred men. In a few days all the promising country for a distance of three miles west of Gowganda had been staked, and search instituted for mineral deposits sufficient to validate the claims. The results on the whole have been highly satisfactory. At the time of my leaving the district I knew of at least four bona fide silver discoveries. At that time systematic prospecting had scarcely begun, the country was everywhere heavily forest-covered, and exploration was impeded, even rendered somewhat hazardous, by the presence of forest fires, so that intimate acquaintance with the area and its possibilities was very difficult to obtain. However, something has been learned concerning the geological structure and the mineral possibilities as visible at the surface. Westward from Gowganda lake the formation is Huronian, traversed in a north and south direction by three elongated bodies of diabase. The more easterly occupies the peninsula between the two long northerly bays of the lake and extends thence northward for about a mile. It has a maximum width of 60 chains. A central mass 7 miles long and about 40 chains wide extends parallel to the west bay and at a distance inland of less than half a mile. A westerly body of about equal dimensions extends from Elkhorn to Firth lake, being traversed by the chain of lakes used in traveling from Gowganda to the West branch. Various fingers and dikes extend from each of these bodies.

In the easterly body, up to the end of September no silver had been found, although a considerable number of mineralized veins were being examined by trenching. These veins occupy fissures in diabase and vary in width from a few inches to 2 ft. The largest of these was reported by the owner, Mr. McLaughlin, to be continuous for a quarter of a mile. The vein matter is, peripherally, quartz, with a central filling of calcite, the relative proportions of the two minerals being quite variable. Chalcopyrite occurs, often abundantly, in all of them, pyrite less frequently. Cobalt bloom is largely in evidence, and on the property of Mr. O'Reilly smaltite was being obtained in small amounts, together with native bismuth. In one vein the calcite was strongly impregnated with minute crystals of magnetite.

The central diabase body has already been proved to be, judging from the surface indications, richly silver-bearing. On a group of four claims owned by Messrs. Mann, Milne, and associates, a vein was seen in which native silver occurs plentifully. The calcite gangue had been weathered out, leaving, in a diabase bluff, a crevice about 5 in. wide filled with decomposed earthy matter. Silver formed a discontinuous vertical sheet as far as the vein had then been uncovered, the average thickness of this sheet being about ¼ in. The lower undecomposed portion of the vein had not been exposed. At other points on these properties native silver, small quantities of argentite, and a 1-in. vein of solid smaltite had been found. Bloom, chalcopyrite, and galena were widely distributed. Farther south, native silver had been obtained in good quantity at the surface by Mr. Dobie and his partner. At the extreme south end of the mass F. A. McIntosh was surface stripping upon a group of seven claims, but at that time without important result. After my departure from the field valuable silver veins were discovered on this property. Silver had also been obtained in the western mass by W. H. Margueratt, the deposit occurring on Margueratt lake near the middle of the diabase body.

Native silver has therefore been proved to exist at points distributed over an area of about 10 sq. m., in much the same mineral association as at Cobalt and neighboring camps. In this case all the finds yet recorded are within the diabase. The Huronian, however, has not been proved to be unmineralized, prospecting having been confined almost wholly to the diabase areas. The aplite dikes have not yet been proved to carry more than a little disseminated smaltite and chalcopyrite, although in James township, not far away, they are ore-bearing. Although not valuable in themselves, in the Gowganda area they may have a positive significance with regard to the existence of mineral deposits. They seem to occur most abundantly where differentiation of the diabase magma has proceeded farthest, and where, if the supposed relation between the diabase and the silver-cobalt mineralization does exist, conditions for the formation of mineralized veins would be most favorable.

The intimate connection between silver deposits and diabase at Gowganda lake naturally draws attention to other diabase bodies in the neighborhood. Of these the most extensive is a great sill-like mass which, beginning on Duncan lake at about three miles from its north end, is followed by that body of water fairly closely to its junction with the West branch; thence southward to where the West branch turns sharply east; thence east, crossing Wapus creek one mile from its mouth, and from there northeastward for about five miles, beyond which it could not be traced. In width it varies from 10 to 60, or more, chains. Very little work had been done on this body during the summer of 1908, although results of search had not been distinctly negative. Very thorough and well directed work was being done on Wapus creek, under the supervision of Robert Lett, with the result that numerous veins and aplite dikes had been exposed and, in cases, had yielded small quantities of bismuth and disseminated smaltite, also abundant bloom and chalcopyrite, but no free silver. The evidences of extensive differentiation at this point are promising signs. Bloom, chalcopyrite, and galena are also to be found throughout the diabase body as seen along Duncan lake.

*Abstracted from Summary Report, Geological Survey Branch, Department of Mines (Canada), 1908.

RUTILE DEPOSITS OF VIRGINIA.

Written for the MINING AND SCIENTIFIC PRESS
By a Special Correspondent.

The General Electric Co. is developing rutile deposits seven miles north and a little west of Tye River station, Nelson county, Virginia. Day and night shifts are now working. The rutile is used in making titanium carbide for electrodes in arc lamps. Ilmeno-rutile, a mineral which has a composition between that of ilmenite and rutile, is also used for similar purposes. It contains more titanium than ilmenite, and much more iron than nigrine, the iron-bearing rutile. It is easily differentiated from ilmenite by its purplish luster, though, like ilmenite, it gives a black powder when crushed. Rutile as found here has a glassy metallic luster, a peculiar purplish color, and gives a brown or light colored powder on crushing.

Both rutile and ilmeno-rutile occur on the property of the General Electric Co. in dikes, composed in the one case of rutile and apatite, and in the other of ilmeno-rutile and apatite. A small amount of ilmenite occurs in both kinds of dikes, and at times they contain some feldspar, and a small amount of biotite. The dikes range up to 5 ft. in thickness.

Ilmenite occurs with apatite in similar dikes, and all of these cut larger dikes of pegmatite which carries rutile. The ilmenite-apatite rock has been called 'nelsonite' by Thomas Leonard Watson, State Geologist of Virginia. The General Electric Co. some time ago shipped several carloads of rutile ore to a Pennsylvania firm for concentration. They have also shipped some of the ilmeno-rutile, and have further stocks of both ready for shipment.

The American Rutile Co. has not been working its deposit for some time, as it had a considerable stock of rutile on hand. This stock is now much depleted, and as the market is at present, active work on these deposits will resume at an early date. This property is at Roseland, about seven miles west of Arrington, Nelson county, and about 3½ miles from the General Electric Co.'s property. The deposit worked at this place is of a totally different character from that being exploited by the General Electric Co. The rutile occurs as an original constituent of a broad pegmatite dike of the same variety as that which forms the country rock on the General Electric Co.'s property at Roseland, and is sufficiently segregated to be workable. The other minerals contained in the dike are albite (forming much the greater part of the rock), bright blue quartz, hornblende, and minor amount of apatite. A small percentage of the concentrate is ilmenite and ilmeno-rutile. Where a very pure rutile product is desired, the latter minerals are taken out by a Wetherill magnetic separator. By this separation the TiO_2, or pure rutile, is run up to over 99%. The firm has an excellent dike of rutile-apatite, so far not worked, as it is desired to keep the product free from phosphorus. There is also an ilmeno-rutile-apatite dike 30 ft. wide on this property. The American Rutile Co.'s workings are all open-cut. They are mining in the face of the hill on the north side of Tye river, from which the rock is quarried. Much of it is decomposed and can be excavated and crushed easily. The dirt overlying the deposit contains a considerable percentage of residual rutile from the decomposition of the pegmatite, and is worked with the rock. Plans are being considered for more extensive working of this dirt. The company has a mill with 10 stamps, 3 Wilfley tables, and ample power and pumps for doubling the capacity of the crushing and separating plant.

Most of this company's product is used in making ferro-titanium for steel manufacture. Smaller amounts go into the making of dyes for leather, mordants, ceramic coloring, and arc-lamp electrodes.

Besides the deposits controlled by these two companies, ilmeno-apatite dikes occur at a number of places in the same region, and they are also found near Roanoke. No other rutile-apatite dikes are known, though there is much of the rutile-bearing pegmatite, but in most if not all of it the rutile is not sufficiently segregated to be profitably worked. Rutile-apatite dikes are not known to occur in any other place, though ilmenite-apatite dikes occur in New Jersey and Lapland. Rutile-bearing granite or pegmatite occurs in southern Norway, South Australia, and possibly in Queensland, Australia.

Some years ago a large iron company obtained control of several thousand acres of land in Nelson county, expecting to work the ilmenite-apatite dikes for iron. At other times there have been projects afoot for working the apatite-bearing dikes for phosphate of lime, but it was not found profitable in competition with the phosphates of the Carolinas and Florida.

DREDGING IN KELANTAN.

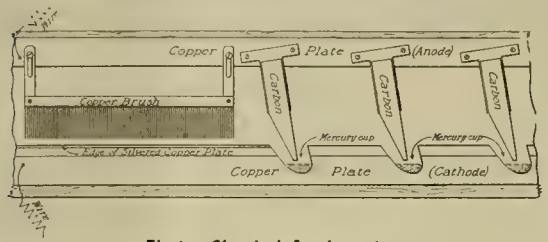
The Duff Development Co. owns the only four dredges on the Kelantan river, which flows to the east coast of the Malay Peninsula, and which is 600 to 800 ft. wide about 100 miles inland, at the place where the dredges have been working. During two months one of the dredges won 1600 oz. gold. The biggest return the company has had from one dredge was 375 oz. for one week. Each dredge has a master, 3 European winchmen—one for each shift—and about 16 native hands. The dredgemasters received a salary of about £400, the European winchmen about £200, and the native coolies, 50c. per day. Firemen and greasers got 60c., and native winchmen 70c. Expenses are considerably heavier than in New Zealand, but a man could have everything necessary for about £2 per week. Generally speaking, the climate is good. It is moist and warm, but not so oppressive as is generally supposed. The rainy season usually lasts only a week or a fortnight, and at such times the rivers rise perhaps 30 or 40 ft. in 24 hours, but fall again just as quickly. There are numbers of other smaller rivers on the Malay Peninsula, on which nothing has ever been done beyond a little prospecting.

Practically nothing has been done to develop the mining industry. There are fairly good prospects for mining, and when the country has been cleared a bit, good alluvial flats and some excellent quartz will probably be found.

Electro-Chemical Amalgamation.

Written for the MINING AND SCIENTIFIC PRESS
By D. F. McGRAW.

The Alling method, which has been incorporated under the name of the Electro-Chemical Gold Saving System, consists of a sluice-box which is made in various sizes and forms to successfully carry out the work it is designed to do, taking the pulp from the battery, also sand and gravel from the sluice-boxes after it has been screened to No. 8 or finer mesh. A standard-size machine which will care for 50 tons of pulp from a mill, or the same number of tons of sand and gravel concentrate per day of 20 hours, is 12 ft. long, 72 ft. wide, inside measurement. It consists of 32 riffles, 24 of which are mercury cups, 2 ft. long, ⅞ in. deep, and 1 in. wide at the top. The first two riffles at the top of the machine spread the material, the last eight catch any 'flour quick' that may come through with the pulp from the battery, or be in the sand or gravel in hydraulicking or ground-sluicing. There are six sets of four mercury cups, into which are placed carbon electrodes, 2 ft. long, 2½ in. wide, and ⅝ in. thick. These carbons serve the double purpose of anode and baffle-plate. After each series of mercury cups is a copper plate, silver plated, 2 ft. long by 7 in. wide, having as anodes, copper brushes, coming into contact with the water, to insure sufficient amperage.



Electro-Chemical Amalgamator.

These brushes are regulated so that any amperage from $^1/_{10}$ to 3 per square foot can be obtained, as the different classes of material demonstrate to be necessary. It is rare that 3 amperes will be necessary. These brushes do not interfere with the flow of the material through the machine. The last eight riffles have iron baffle-plates. Both carbon and iron plates are fixed firmly in the machine, but are easily removable for the purposes of cleaning up.

Material entering the machine is evenly distributed by the first two riffles. It then comes in contact with the first set of baffle-plates, which depress the entire mass into the mercury cups, and it then runs over the silver plate, striking another series of carbons and mercury cups. It continues until it has passed the 24 baffle-plates and has been depressed into the 24 cups. By this time the gold and platinum has been deposited on the plates and in the cups, but there may be 'flour quick' which carries gold. To save this, the 8 riffles with the iron baffle-plates, below the mercury cups, have been provided.

Mercuric chloride in solution is the chemical used in connection with the electric current. It is fed into the machine with the material. It is very diffusible in water, mixing in a similar manner to that of milk and tea. The electric current being turned on decomposes the mercuric chloride into its original component parts of mercury (nascent quicksilver) and chlorine. The mercury being metallic, and electro-positive, seeks the cathode, which is the copper plates and mercury cups, being the bottom portion of the machine. The chlorine being non-metallic, and electro-negative, seeks the anode, which is the carbon baffle-plates. The chlorine, after it has parted from the mercury, is constantly coming in contact with the fine particles of gold that are floating in or on the top of the water or pulp, and cleans them from all grease or rust, leaving the gold in a perfect state for amalgamation. The material is constantly being turned over by coming in contact with the baffle-plates and the consequent depression into the mercury-cups, which places all of the particles of gold where they are constantly surrounded by newly formed quicksilver, or, as one very happily put it, the "gold is in a mercury fog until it's caught." When the gold particles have been covered with this fresh quicksilver they attach themselves to the plates, or are caught in the mercury cups as they pass through, their weight, with the mercury with which they have been amalgamated, being more than sufficient to give the gold the required specific gravity to reach the bottom of the machine.

By this electric action fresh quicksilver is constantly being deposited on the plates, keeping them 'dressed' or in a condition for the most perfect form for amalgamation. The same electrical action keeps the mercury constantly 'alive and bright' in the mercury cups.

Under normal conditions mercury has no amalgamating power with platinum. Several instances have occurred, however, in our tests where a current of 30 volts has amalgamated platinum and gold perfectly. In other cases with the same voltage, and seemingly the same conditions, no amalgamating tendency was shown. The appliance has been saving from 97 to 99% of the assay values of all platinum-bearing material that has been submitted. The following tests were made on difficult gold and platinum-bearing material. The material was weighed, assays made of the 'heads' and again of the tailing after passing through the machine; black sand concentrate sized to number 10 mesh, from the Hess & Hagerman mine, Jolon, Monterey county, California; reported on by Ernest H. Simonds, of San Francisco:

Samples, 2.	Heads, gold.	Tailing. gold.
1	$31.00	$0.40
2	44.00	0.41

Disintegrated quartz and porphyry; ground to No. 100 mesh; Dayton, Nevada; reported on by Smith, Emery & Co., San Francisco:

Samples, 4.	Heads, gold.	Tailing. gold
1	$11.58	$0.20
2	7.34	0.40
3	5.17	0.41
4	4.96	0.41

Black-sand concentrate sized to number 10 mesh; 80% of mass magnetic iron, carrying a large amount of 'flour' quicksilver; reported on by Harold G. Ward, of the C. A. Luckhard Assaying Co., San Francisco:

	Heads		Tailing	
Sample, 1.	Gold.	Platinum.	Gold.	Platinum.
1	$156.07	$74.40	$0.41	$0.81

The machine was cleaned thoroughly, and re-distilled mercury was used in the cups. After the material had been run through the machine it was cleaned up, the mercury retorted, and the clean-up compared with the assay-values. Comparable results have been obtained in fully 200 tests. The significance of such figures will appeal to all who are familiar with the metallurgy of gold and silver.

Production of Coal in Oregon in 1908.

The total production of coal in Oregon in 1908, as shown by statistics collected by E. W. Parker, of the United States Geological Survey, was 86,259 short tons, having a spot value of $236,021. Oregon, like California, is one of the few States in which the coal production in 1908 showed an increase over that of the preceding year, which was 70,981 short tons, the 1908 output being therefore a gain of 15,278 short tons, or 21.52%; the value increased from $166,304 to $236,-021, a gain of $69,717, or 41.92%. All of the coal produced came from the Coos Bay field, in Coos county, and the increased production in 1908 was due to an increased activity at the Beaver Hill mines. All the Beaver Hill coal was washed, the operations yielding 70% cleaned coal. The coal from this field is of lignitic character. The average number of men employed increased from 184 in 1907 to 214 in 1908, and the average number of days worked increased from 231 to 249. There were no labor disturbances during the year.

Mineral Production of New York in 1908.*

Product.	Unit of measurement.	Quantity.	Value.
Portland cement	Barrels	1,988,874	$1,813,623
Natural rock cement	Barrels	623,618	441,136
Building brick	Thousands	1,065,533	5,200,951
Pottery	.....	.....	1,653,241
Other clay products	.....	.....	2,064,671
Crude clay	Short tons	4,697	11,605
Emery	Short tons	690	8,860
Feldspar and quartz	Short tons	20,360	66,304
Garnet	Short tons	2,480	79,890
Graphite	Pounds	1,932,000	116,100
Gypsum	Short tons	318,046	760,759
Iron ore	Long tons	703,473	2,098,247
Millstones	.....	.....	18,341
Metallic paint	Short tons	5,750	54,500
Slate pigment	Short tons	922	7,376
Mineral waters	Gallons	8,007,092	877,648
Natural gas	1000 cu. ft.	3,860,000	987,775
Petroleum	Barrels	1,160,128	2,071,533
Pyrite	Long tons	23,775	104,798
Salt	Barrels	9,005,311	2,136,736
Sand and gravel	.....	.....	1,130,291
Sand-lime brick	Thousands	8,239	55,688
Slate	.....	.....	111,217
Granite	.....	.....	367,564
Limestone	.....	.....	3,119,835
Marble	.....	.....	692,857
Sandstone	.....	.....	1,711,585
Trap	.....	.....	723,773
Talc	Short tons	70,739	697,390
Other materials†	.....	.....	333,648
Total value			$29,517,942

*Statistics collected by John M. Clarke, State Geologist, in co-operation with the U. S. Geological Survey.

†Includes apatite, carbon dioxide, diatomaceous earth, and marl.

Commercial Paragraphs.

The Standard Underground Cable Co. has moved its San Francisco office to the First National Bank building.

The Keystone Placer Drill Co., Beaver Falls, Pa., has made shipment of seven large double-stroke geared deep-well pumps for the town of Zacatecas, Mexico. The pumps are part of a million dollar water-supply plant for the city which is being installed by the Government of Mexico.

Crocker & Ketchum is the style of a newly formed partnership for practice as consulting engineers along the lines of steel and reinforced construction, mine and mill buildings, examinations and reports. The partners are Herbert S. Crocker and Milo S. Ketchum. Their offices are at 811 Seventeenth street, Denver, Colorado.

The American Locomotive Co. has recently issued pamphlet No. 10035, describing the joint exhibit of that company and the Atlantic Equipment Co. at the Alaska-Yukon-Pacific Exposition, in progress at Seattle, Washington. The exhibit consists of a rotary snow-plow; two locomotives, one a six-coupled tank or 2-6-2 T type locomotive for logging service, and the other a 10 by 16-in. four-wheel saddle-tank contractor's locomotive; an electric motor and trailer truck, and a new model Atlantic steam-shovel.

The Wood Drill Works, Paterson, N. J., has appointed Fairbanks, Morse & Co., of Seattle and Spokane, Washington, as exclusive representatives for the State of Washington. A large stock of drills, accessories, and repairs are now on hand at the Spokane and Seattle stores, with catalogues and full literature on the Wood rock drill, including the company's latest booklet, 'Glimpses of the Pamana Canal'. On exhibit at Seattle is a nickel-plated 2½-in. drill, so perfect in workmanship and construction that the drill can be operated by the human breath.

Utah's Coal Output in 1908.

The total production of coal in Utah in 1908, according to information obtained by E. W. Parker, of the U. S. Geological Survey, was 1,846,792 short tons, having a spot value of $3,119,338. The figures show a decrease of 100,815 short tons, or 5.18%, in quantity, but an advance of $159,569, or 5.39%, in value in price over 1907. The average price per ton rose from $1.52 to $1.69. This increase in value and advance in price, in the face of the general financial depression, can be accounted for only by the increased expense of mining due to a lessened productive capacity of the mine-workers. In 1905 the average daily production for each man employed in the coal mines of Utah was 396 tons; in 1906 it was 392 tons; in 1907 it was 343 tons; and in 1908 it was 305 tons. Practically all the mines in the State are operated under agreements with the United Mine Workers of America, and out of a total of 2664 men, 2620 worked at mines operated on the basis of an eight-hour day. As in the other coal-producing states of the Rocky Mountain region, the number of men employed in the mines shows an increase from 2203 in 1907 to 2664 in 1908. The average number of working days decreased from 258 in 1907 to 227 in 1908. The supply of cars was in general ample throughout the year, and there was no trouble from strikes, lockouts, or other labor difficulties. The second half of the year showed a marked improvement over the first half, and the conditions in the metalliferous mining industry at the end of the year were gradually improving, so that the outlook for the coal mines in 1909 was hopeful.

Antimonial Lead.

During the years 1907 and 1908 antimonial lead was produced in the United States, according to the U. S. Geological Survey, as follows:

	1907.	1908.
Antimonial lead	9,910	13,629
Antimony contents	1,560.5	2,440
Approximate percentage of foreign origin	27	37

A considerable quantity of antimony was recovered from drosses, old type metal, and similar sources by firms making a specialty of this branch of metallurgy, but complete figures are not at hand. There was no production of metallic antimony from domestic ores in 1908.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the Mining and Scientific Press.

Oil and Gas in the St. Louis District. By H. A. Wheeler. Jour. Assoc. Eng. Soc., Vol. 42, No. 4, pp. 188-199. April 1909.

Some Central Idaho Gold Districts. By S. P. Jellum. 8vo., pp. 83. Northwest Mining News. Spokane, 1909. Price 50 cents.

Production of Cement in Canada, 1908. By John McLeish. Department of Mines, Mines Branch. 8vo., pp. 4. Ottawa, 1909.

Production of Salt and Bromine in 1908. By W. C. Phalen. Advance chapter Mineral Resources of the United States, U. S. Geol. Surv., pp. 18. Washington, 1909.

Geology and Water Resources of the Harney Basin Region, Oregon. By Gerald A. Waring, U. S. Geol. Surv., Water Supply Paper 231. 8vo., pp. 93, map. Washington, 1909.

Catalogues Received.

The Dearborn Drug & Chemical Works, Chicago, is distributing an attractive booklet called 'Lubrication Versus Friction.' Send for it.

The Westinghouse Electric & Mfg. Co., in its folder No. 4132, shows many novel and practical uses for electric motors around the shop, store, and office.

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